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Attorneys for Defendant
AIR & LIQUID SYSTEMS CORPORATION,
successor by merger to BUFFALO PUMPS, INC.

UNITED STATES DISTRICT COURT

SOUTHERN DISTRICT OF CALIFORNIA

WILLIAM W. MANSIR and TERI M. MANSIR,

Plaintiffs,

v.

AIR & LIQUID SYSTEMS CORPORATION (sued individually and as successor by merger to BUFFALO PUMPS, INC.); **ALFA LAVAL INC.** (sued individually and as successor-in-interest to DELAVAL SEPARATOR COMPANY and SHARPLES, INC.); **BRAKE GATE, LTD.; CBS CORPORATION** (f/k/a WESTINGHOUSE ELECTRIC CORPORATION); **CERTAINTEED CORPORATION; CRANE CO; GENCOR. LTD; GENERAL ELECTRIC COMPANY; GEORGIA-PACIFIC LLC** (sued individually and as successor-in-interest to BESTWALL GYPSUM COMPANY); **IMO INDUSTRIES, INC.** (sued individually and as successor-in-interest to DELAVAL TURBINE, INC.); **INGERSOLL-RAND COMPANY; JOHN K. BICE CO., INC.; JOHN CRANE INC.; KAISER GYPSUM COMPANY, INC.; KELLY-MOORE PAINT COMPANY, INC.; M. SLAYEN AND ASSOCIATES, INC.; PARKER-HANNIFIN CORPORATION** (sued individually and as successor-in-interest

CASE NO. '10 CV 2617 LAB BGS
San Diego County Superior Court
37-2010-00104112-CU-AS-CTL

NOTICE OF REMOVAL OF ACTION UNDER 28 U.S.C. SECTIONS 1442 AND 1446

to SACOMA-SIERRA, INC.); **SOCO WEST, INC.** f/k/a SOCO-LYNCH CORPORATION, a/k/a SOCO-WESTERN CHEMICAL CO., a/k/a STINNES OIL & CHEMICAL COMPANY (sued individually and as successor-in-interest to WESTERN CHEMICAL AND MANUFACTURING COMPANY); **SYD CARPENTER, MARINE CONTRACTOR, INC.; UNION CARBIDE CORPORATION; WARREN PUMPS LLC; YARWAY CORPORATION; and DOES 1-350 INCLUSIVE,**

Defendants.

TO THE CLERK AND THE HONORABLE JUDGE OF THE ABOVE-ENTITLED COURT:

PLEASE TAKE NOTICE that, pursuant to 28 U.S.C. sections 1442 and 1446, defendant AIR & LIQUID SYSTEMS CORPORATION, SUCCESSOR BY MERGER TO BUFFALO PUMPS, INC. ("Buffalo Pumps") individually hereby gives notice of the removal of this action, originally filed in the San Diego Angeles County Superior Court, to the United States District Court for the Southern District of California based on the following grounds:

1. **Jurisdiction.** This Court has subject matter jurisdiction over this case because the claims involve a person, Buffalo Pumps, acting under the authority of an officer or agency of the United States. 28 U.S.C. § 1442; *Freiberg v. Swinerton & Walberg Property Services, Inc.* 245 F.Supp.2d 1144, 1150 (2002).

2. **Intradistrict Assignment.** The claims are pending within the District and the Division of this Court. Therefore, the claims should be assigned to this Division.

3. **Timeliness.** This Notice of Removal is timely because it was filed within thirty (30) days of formal service of the Summons and Complaint upon Buffalo Pumps, consistent with the requirements of 28 U.S.C. section 1446(b) and Rule 6 of the Federal Rules of Civil Procedure.

4 **Background.** On or about November 15, 2010, plaintiffs filed their Complaint

against approximately 20 defendants, including Buffalo Pumps, in the Superior Court of the State of California, County of San Diego.

5. In the Complaint, Plaintiffs WILLIAM W. MANSIR and TERI M. MANSIR (plaintiffs) allege WILLIAM W. MANSIR was exposed to asbestos containing products manufactured by a number of defendants, including Buffalo Pumps, while employed by the United States Navy. (A true and correct copy of the Summons and Complaint is attached as **Exhibit 1** to this Notice of Removal.)

6. Any equipment manufactured for the U.S. Navy by Buffalo Pumps to be used aboard U.S Naval vessels or in a Naval shipyard was manufactured under the direction and control of a federal officer. (See, generally, Declaration of Ret. Adm. Roger Horne, **Exhibit 2** and the Declaration of Martin Kraft, **Exhibit 3**.) Buffalo Pumps manufactured and designed equipment sold to the Navy according to the precise, detailed specifications of the U.S. Navy. The United States Navy enforced compliance with those design specifications and no aspect of the design of that equipment escaped the close control of the United States Navy and its officers, including all aspects of warnings associated with the equipment. (*Id.*) Accordingly, Buffalo Pumps was acting under an officer or agent of the United States within the meaning of 28 U.S.C. § 1442(a)(1).

7. **Legal Authorities**. Should plaintiffs file a motion to remand in this case, Buffalo Pumps requests an opportunity to respond more fully in writing, but, for now, offers the following authorities:

8. Removal is appropriate where, as here, the removing party (1) acted under the direction of a federal officer; (2) raises a colorable federal defense to plaintiffs' claims and (3) can demonstrate a causal nexus between plaintiffs' claims and the acts it performed under color of federal office. *Mesa v. California*, 489 U.S. 121, 124-25 (1989).

9. In 2006, the Ninth Circuit unequivocally stated that "the Supreme Court has mandated a generous interpretation of the federal officer removal statute . . . [and] has held that the right of removal is absolute for conduct performed under color of federal office, and has insisted that the policy favoring removal should not be frustrated by a narrow, grudging

interpretation of § 1442(a)(1)." *Durham v. Lockheed Martin Corp.*, 445 F. 3d 1247, 1252 (9th Cir. 2006) (citations omitted). In light of the *Durham* court's ruling, California federal district courts have repeatedly interpreted section 1442 broadly in favor of removal where a manufacturer of equipment demonstrates that it acted under the direction of a federal officer, raises a colorable federal defense to plaintiffs' claims and establishes a causal connection between its alleged action under the control of a federal officer and plaintiffs' claims. *See, e.g., Ballenger v. Agco Corp.*, 2007 WL 1813821 (N.D. Cal. June 22, 2007) (a copy of Judge Wilken's Order is attached as **Exhibit 4**); *Nelson v. Alfa Laval, Inc.* et al, CV 07-8338VBF(RCx) (a copy of Judge Fairbank's Order is attached as **Exhibit 5**); *Wright v. A.W Chesterton, Inc.*, CV 07-05403MJJ (a copy of Judge Jenkin's Order is attached as **Exhibit 6**); *Oberstar v. CBS Corp.*, CV 08-118PA (JWJx) (a copy of this order is attached as **Exhibit 7**); *Jenkins v. Allied Packing and Supply, Inc.* 09 CV101-DMS, (a copy of this order is attached as **Exhibit 8**).

10. As recognized in *Boyle v. United Technologies Corp.*, 487 U.S. 500 (1988), Buffalo Pumps has a federal defense to this action: i.e., government contractor immunity from liability for injuries arising from any exposure to asbestos-containing equipment on board United States Navy vessels, or at U.S. Navy land based installations, insofar as they were manufactured or supplied by Buffalo Pumps. See also *Carley v. Wheeled Coach,* 991 F.2d 1117, 1123 (3d Cir. 1993); *Kleeman v. McDonnell Douglas Corp.*, 890 F.2d 698, 700 (4th Cir. 1989); *Garner v. Santoro,* 865 F.2d 629, 634 (5th Cir. 1991).

11. Removal on federal officer (e.g., federal contractor) grounds is also allowed in failure to warn cases. In *Kerstetter v. Pacific Scientific Co.*, 210 F. 3d 431, 438 (5th Cir.) *cert. denied* 519 U.S. 919 (2000), the court held that the government contractor defense is available in "failure to warn" actions where the evidence shows that the lack of a warning reflects governmental direction and control rather than the unfettered discretion of the product's manufacturer.

12. As noted in *Kerstetter,* "[t]he government need not prepare the specifications to be considered to have approved them." *Id* at 435. The only material issue is whether the manufacturer's designs and specifications were subjected to "substantial review" rather than a

mere "rubber stamp" approval. *Id.* Substantial review is established where there is evidence of a "continuous back and forth" between the contractor and the government." *Id.* In this regard, "[t]he specifications need not address the specific defect alleged; the government need only evaluate the design feature in question." *Id.* Applying these general principals to "failure to warn" claims, the fact that government specifications or regulations did not specifically preclude the exact warning desired by a plaintiffs does not take a "failure to warn" claim outside the scope of a government contractor defense, so long as the government was generally involved in decisions relating to product warnings and was aware of the hazard in question. *Id* at 438.

13. Further, according to Ret. Admiral Roger Horne: "The Navy retained the final say over the design of any piece of equipment and made the ultimate decision regarding how to resolve an engineering disagreement between the Navy and an outside supplier. Without prior discussion, approval and acceptance by the Navy, a warning related to asbestos hazards would not have been permitted." See **Exhibit 2**, page 5 at ¶ 12.)

14. "[A]ll equipment, including pumps supplied by Buffalo Pumps for use aboard Navy vessels, was manufactured pursuant to Navy specifications under close supervision by personnel employed by the Navy and approved for installation aboard these vessels exclusively by the Navy and its designated officers. Any warning purportedly required by state law would not have found its way into a ship as a permanent label on a pump or as a warning in accompanying written materials unless it had been required specifically in the specifications for the product that were issued by the Navy." *Id* at ¶ 15.

15. As explained in the declaration of Martin Kraft: "In the design phase of the pump project, as in all other phases, the Navy retained ultimate decision authority over the design of the pumps. If engineering disagreements arose between the Navy and an outside design consultant, the Navy controlled the design adopted. All pumps supplied by Buffalo Pumps to the Navy were built in accordance with the Navy specifications or other technical documentation identified in applicable contract documents." See **Exhibit 3**, page 3 at ¶ 8.

16. In addition: "Navy specifications or other technical documents identified in applicable contract documents required Buffalo Pumps to submit for approval and acceptance by

the federal government drafts of any manuals, drawings or other written materials required to be provided with regard to pumps it manufactured for the Navy. These requirements were far more detailed and stringent than those imposed by commercial customers. (Exhibit A at 3.5; 3.6; Exhibit B at 3.27; 3.28)." *Id* at ¶ 13.

17. This approval and acceptance process was not merely a process of submission by Buffalo Pumps of drawings and manuals. The Navy's review encompassed all aspects of the technical manuals and other written materials submitted to it for approval in the pump design and manufacture process. Based on my experience and my review of historical materials, I am aware that the Navy required specific changes to the content and wording of manuals submitted by Buffalo Pumps and other naval equipment manufacturers. These changes included specific edits to cautionary and instructional language, and including warnings and cautions. Examples of correspondence of this type are attached as Exhibit C." *Id* at ¶ 14.

18. Buffalo Pumps is not required to notify and obtain the consent of any other defendant in this action in order to remove plaintiffs' action as a whole under 28 U.S.C. §1442(a)(l). *Ely Valley Mines, Inc. v. Hartford Accident Indem. Co.*, 644 F.2d 1310, 1315 (9th Cir. 1981); *Akin v. Ashland Chem. Co.*, 156 F.3d 1030, 1034-35 (1998).

19. A properly removed case cannot be remanded for discretionary or policy reasons, such as allegations of related state cases or contentions that judicial economy compels remand. *Thermitron Products, Inc. v. Hermansdorfer,* 423 U.S. 336, 343-44 (1976); *Elrad v. United Life & Accident Ins. Co.*, 624 F. Supp. 742, 743 (N.D. Ill. 1985).

20. Buffalo Pumps has attached those documents required by 28 U.S.C. section 1446(a) and (b) and the local rules of the United States District Court, Southern District of California, including a copy of the Summons and Complaint filed against it by the plaintiffs. **Exhibit 1.**

///

WHEREFORE, defendant Buffalo Pumps Inc. respectfully requests that the above action now pending against it in the Superior Court of California, County of San Diego, be removed to this Court.

Dated: December 15, 2010

GORDON & REES LLP

By: _____
MICHAEL J. PIETRYKOWSKI
GLEN R. POWELL
Attorneys for Defendant
AIR & LIQUID SYSTEMS CORPORATION, Successor By Merger To BUFFALO PUMPS, INC.

Exhibit 1

CT Corporation

Service of Process Transmittal
11/23/2010
CT Log Number 517645862

TO: Rose Hoover, Vice Pres. Admin. and Corporate Sec.
Ampco-Pittsburgh Corporation
600 Grant Street, Suite 4600
Pittsburgh, PA 15219

RE: **Process Served in Pennsylvania**

FOR: Air & Liquid Systems Corporation (Domestic State: PA)

ENCLOSED ARE COPIES OF LEGAL PROCESS RECEIVED BY THE STATUTORY AGENT OF THE ABOVE COMPANY AS FOLLOWS:

TITLE OF ACTION:	William W. Mansir and Teri M. Mansir, Pltfs. vs. Air & Liquid Systems Corporation, etc., et al., Dfts.
DOCUMENT(S) SERVED:	Summons, Complaint, Exhibits, Cover Sheet,
COURT/AGENCY:	San Diego Superior Court, CA Case # 37-2010-00104112-CU-AS-CTL
NATURE OF ACTION:	Asbestos Litigation - Personal Injury
ON WHOM PROCESS WAS SERVED:	CT Corporation System, Harrisburg, PA
DATE AND HOUR OF SERVICE:	By Process Server on 11/23/2010 at 10:55
APPEARANCE OR ANSWER DUE:	Within 30 days
ATTORNEY(S) / SENDER(S):	Michael L. Armitage Waters, Kraus & Paul 222 North Sepunda Boulevard Suite 1900 El Segundo, CA 90245 310-414-8146
ACTION ITEMS:	CT has retained the current log, Retain Date: 11/23/2010, Expected Purge Date: 11/28/2010 Image SOP Email Notification, Rose Hoover RHOOVER@AMPCOPGH.COM Email Notification, Jess Nock jnock@ampcopgh.com Email Notification, Jen Sauers jsauers@ampcopgh.com Email Notification, Nicole Sayles nsayles@ampcopgh.com Email Notification, Insurance Department insurance@ampcopgh.com
SIGNED:	CT Corporation System
PER:	Sabra Dudding
ADDRESS:	116 Pine Street 3rd Floor, Suite 320 Harrisburg, PA 17101
TELEPHONE:	717-234-6004

SUM-100

SUMMONS
(CITACION JUDICIAL)

FOR COURT USE ONLY
(SOLO PARA USO DE LA CORTE)

FILED
BUSINESS OFFICE 13

2010 NOV 15 A 11:58

CLERK
SAN DIEGO, CA

NOTICE TO DEFENDANT: AIR & LIQUID SYSTEMS CORPORATION
(AVISO AL DEMANDADO): (sued individually and as successor by merger to BUFFALO PUMPS, INC.) et al.

YOU ARE BEING SUED BY PLAINTIFF: WILLIAM W. MANSIR and
(LO ESTÁ DEMANDANDO EL DEMANDANTE): TERI M. MANSIR

NOTICE! You have been sued. The court may decide against you without your being heard unless you respond within 30 days. Read the information below.

You have 30 CALENDAR DAYS after this summons and legal papers are served on you to file a written response at this court and have a copy served on the plaintiff. A letter or phone call will not protect you. Your written response must be in proper legal form if you want the court to hear your case. There may be a court form that you can use for your response. You can find these court forms and more information at the California Courts Online Self-Help Center (*www.courtinfo.ca.gov/selfhelp*), your county law library, or the courthouse nearest you. If you cannot pay the filing fee, ask the court clerk for a fee waiver form. If you do not file your response on time, you may lose the case by default, and your wages, money, and property may be taken without further warning from the court.

There are other legal requirements. You may want to call an attorney right away. If you do not know an attorney, you may want to call an attorney referral service. If you cannot afford an attorney, you may be eligible for free legal services from a nonprofit legal services program. You can locate these nonprofit groups at the California Legal Services Web site (*www.lawhelpcalifornia.org*), the California Courts Online Self-Help Center (*www.courtinfo.ca.gov/selfhelp*), or by contacting your local court or county bar association. **NOTE:** The court has a statutory lien for waived fees and costs on any settlement or arbitration award of $10,000 or more in a civil case. The court's lien must be paid before the court will dismiss the case.

¡AVISO! Lo han demandado. Si no responde dentro de 30 días, la corte puede decidir en su contra sin escuchar su versión. Lea la información a continuación.

Tiene 30 DÍAS DE CALENDARIO después de que le entreguen esta citación y papeles legales para presentar una respuesta por escrito en esta corte y hacer que se entregue una copia al demandante. Una carta o una llamada telefónica no lo protegen. Su respuesta por escrito tiene que estar en formato legal correcto si desea que procesen su caso en la corte. Es posible que haya un formulario que usted pueda usar para su respuesta. Puede encontrar estos formularios de la corte y más información en el Centro de Ayuda de las Cortes de California (www.sucorte.ca.gov), en la biblioteca de leyes de su condado o en la corte que le quede más cerca. Si no puede pagar la cuota de presentación, pida al secretario de la corte que le dé un formulario de exención de pago de cuotas. Si no presenta su respuesta a tiempo, puede perder el caso por incumplimiento y la corte le podrá quitar su sueldo, dinero y bienes sin más advertencia.

Hay otros requisitos legales. Es recomendable que llame a un abogado inmediatamente. Si no conoce a un abogado, puede llamar a un servicio de remisión a abogados. Si no puede pagar a un abogado, es posible que cumpla con los requisitos para obtener servicios legales gratuitos de un programa de servicios legales sin fines de lucro. Puede encontrar estos grupos sin fines de lucro en el sitio web de California Legal Services, (www.lawhelpcalifornia.org), en el Centro de Ayuda de las Cortes de California, (www.sucorte.ca.gov) o poniéndose en contacto con la corte o el colegio de abogados locales. AVISO: Por ley, la corte tiene derecho a reclamar las cuotas y los costos exentos por imponer un gravamen sobre cualquier recuperación de $10,000 ó más de valor recibida mediante un acuerdo o una concesión de arbitraje en un caso de derecho civil. Tiene que pagar el gravamen de la corte antes de que la corte pueda desechar el caso.

The name and address of the court is:
(El nombre y dirección de la corte es):
San Diego Superior Court
300 West Broadway

San Diego, CA 92101

CASE NUMBER
(Número del Caso):
37-2010-00104112-CU-AS-CTL

The name, address, and telephone number of plaintiff's attorney, or plaintiff without an attorney, is:
(El nombre, la dirección y el número de teléfono del abogado del demandante, o del demandante que no tiene abogado, es):
Michael L. Armitage, CA Bar No. 152740 310-414-8156
Waters, Kraus & Paul
222 N. Sepulveda Blvd.
El Segundo, CA 90245

DATE: NOV 15 2010 (Fecha)
Clerk, by _____, Deputy
(Secretario) (Adjunto)

(For proof of service of this summons, use Proof of Service of Summons (form POS-010).)
(Para prueba de entrega de esta citatión use el formulario Proof of Service of Summons, (POS-010)).

(SEAL)

NOTICE TO THE PERSON SERVED: You are served
1. ☐ as an individual defendant.
2. ☐ as the person sued under the fictitious name of *(specify):* AIR & LIQUID SYSTEMS CORPORATION (sued individually and as successor by merger to BUFFALO PUMPS, INC.)
3. ☐ on behalf of *(specify):*
under: ☐ CCP 416.10 (corporation) ☐ CCP 416.60 (minor)
☐ CCP 416.20 (defunct corporation) ☐ CCP 416.70 (conservatee)
☐ CCP 416.40 (association or partnership) ☐ CCP 416.90 (authorized person)
☐ other *(specify):*
4. ☐ by personal delivery on *(date):*

Page 1 of 1

SUM-200(A)

SHORT TITLE: MANSIR, et al. vs. Air & Liquid Systems Corporation, et al.	CASE NUMBER:

INSTRUCTIONS FOR USE

- This form may be used as an attachment to any summons if space does not permit the listing of all parties on the summons.
- If this attachment is used, insert the following statement in the plaintiff or defendant box on the summons: "Additional Parties Attachment form is attached."

List additional parties *(Check only one box. Use a separate page for each type of party.)*:

☐ Plaintiff ☒ Defendant ☐ Cross-Complainant ☐ Cross-Defendant

ALFA LAVAL INC. (sued individually and as successor-in-interest to DELAVAL SEPARATOR COMPANY and SHARPLES, INC.)
BRAKE GATE, LTD;
CBS CORPORATION (f/k/a VIACOM, INC., successor by merger with CBS CORPORATION f/k/a WESTINGHOUSE ELECTRIC CORPORATION);
CERTAINTEED CORPORATION;
CRANE CO;
GENCOR, LTD.;
GENERAL ELECTRIC COMPANY;
GEORGIA-PACIFIC LLC (sued individually and as successor-in-interest to BESTWALL GYPSUM COMPANY);
IMO INDUSTRIES, INC. (sued individually and as successor-in-interest to DE LAVAL TURBINE, INC.)
INGERSOLL-RAND COMPANY;
JOHN K. BICE CO., INC.;
JOHN CRANE, INC.;
KAISER GYPSUM COMPANY, INC.;
KELLY-MOORE PAINT COMPANY, INC.;
M. SLAYEN AND ASSOCIATES, INC.;
PARKER-HANNIFIN CORPORATION (sued individually and as successor-in-interest to WESTERN CHEMICAL AND MANUFACTURING COMPANY);
SOCO WEST, INC. f/k/a BRENNTAG WEST, INC. f/k/a SOCO-LYNCH CORPORATION, a/k/a SOCO-WESTERN CHEMICAL CO., a/k/a STINNES OIL & CHEMICAL COMPANY (sued individually and as successor-in-interest to WESTER CHEMICAL AND MANUFACTURING COMPANY)
SYD CARPENTER, MARINE CONTRACTOR, INC.;
UNION CARBIDE CORPORATION;
WARREN PUMPS LLC;
YARWAY CORPORATION;
DOES 1-350 INCLUSIVE

Form Adopted for Mandatory Use
Judicial Council of California
SUM-200(A) [Rev. January 1, 2007]

ADDITIONAL PARTIES ATTACHMENT
Attachment to Summons

MICHAEL L. ARMITAGE, ESQ., CA Bar No. 152740
JOHN S. JANOFSKY, ESQ., CA Bar No. 74586
MARK D. BRATT, ESQ., CA Bar No. 246103
WATERS, KRAUS & PAUL
222 N. Sepulveda Blvd., Suite 1900
El Segundo, California 90245
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Fax: (310) 414-8156

Attorneys for Plaintiffs

SUPERIOR COURT OF THE STATE OF CALIFORNIA

FOR THE COUNTY OF SAN DIEGO

WILLIAM W. MANSIR and TERI M. MANSIR,

Plaintiffs,

vs.

AIR & LIQUID SYSTEMS CORPORATION (*sued individually and as successor by merger to* BUFFALO PUMPS, INC.);
ALFA LAVAL INC. (*sued individually and as successor-in-interest to* DELAVAL SEPARATOR COMPANY and SHARPLES, INC.);
BRAKE GATE, LTD;
CBS CORPORATION (*f/k/a* VIACOM, INC., *successor by merger with* CBS CORPORATION *f/k/a* WESTINGHOUSE ELECTRIC CORPORATION);
CERTAINTEED CORPORATION;
CRANE CO;
GENCOR, LTD.;
GENERAL ELECTRIC COMPANY;
GEORGIA-PACIFIC LLC (*sued individually and as successor-in-interest to* BESTWALL GYPSUM COMPANY);
IMO INDUSTRIES, INC. (*sued individually and as successor-in-interest to* DE LAVAL TURBINE, INC.)
INGERSOLL-RAND COMPANY;
JOHN K. BICE CO., INC.;

Case No. 37-2010-00104112-CU-AS-CTL

THIS ACTION CONSTITUTES COMPLEX ASBESTOS LITIGATION – SUBJECT TO THE GENERAL ORDERS CONTAINED IN FILE NO. 828684

COMPLAINT FOR PERSONAL INJURY – ASBESTOS (NEGLIGENCE; STRICT LIABILITY; FALSE REPRESENTATION; INTENTIONAL TORT/INTENTIONAL FAILURE TO WARN; LOSS OF CONSORTIUM)

JOHN CRANE INC.;
KAISER GYPSUM COMPANY, INC.;
KELLY-MOORE PAINT COMPANY, INC.;
M. SLAYEN AND ASSOCIATES, INC.;
PARKER-HANNIFIN CORPORATION *(sued individually and as successor-in-interest to* SACOMA-SIERRA, INC.);
SOCO WEST, INC. f/k/a BRENNTAG WEST, INC. f/k/a SOCO-LYNCH CORPORATION, a/k/a SOCO-WESTERN CHEMICAL CO., a/k/a STINNES OIL & CHEMICAL COMPANY (*sued individually and as successor-in-interest to* WESTERN CHEMICAL AND MANUFACTURING COMPANY);
SYD CARPENTER, MARINE CONTRACTOR, INC.;
UNION CARBIDE CORPORATION;
WARREN PUMPS LLC;
YARWAY CORPORATION;
and DOES 1-350 INCLUSIVE,

Defendants.

GENERAL ALLEGATIONS

COME NOW Plaintiffs WILLIAM W. MANSIR and TERI M. MANSIR (hereinafter "Plaintiffs") and complains and allege as follows:

1. The true names and capacities, whether individual, corporate, associate, governmental or otherwise, of Defendants DOES 1 through 350, inclusive, are unknown to Plaintiffs at this time, who therefore sues said Defendants by such fictitious names. When the true names and capacities of said Defendants have been ascertained, Plaintiffs will amend this complaint accordingly. Plaintiffs are informed and believe, and thereon allege, that each Defendant designated herein as a DOE is responsible, negligently or in some other actionable manner, for the events and happenings hereinafter referred to, and caused injuries and damages proximately thereby to the Plaintiffs, as hereinafter alleged.

2. At all times herein mentioned, each of the Defendants was the agent, servant, employee and/or joint venturer of his co-Defendants, and each of them, and at all said times each Defendant was acting in the full course and scope of said agency, service, employment and/or joint venture. Plaintiffs

are informed and believe, and thereon allege that at all times herein mentioned, Defendants **AIR & LIQUID SYSTEMS CORPORATION** (*sued individually and as successor by merger to* BUFFALO PUMPS, INC.); **ALFA LAVAL INC.** (*sued individually and as successor-in-interest to* DELAVAL SEPARATOR COMPANY and SHARPLES, INC.); **BRAKE GATE, LTD**; **CBS CORPORATION** (*f/k/a* VIACOM, INC., *successor by merger with* CBS CORPORATION *f/k/a* WESTINGHOUSE ELECTRIC CORPORATION); **CERTAINTEED CORPORATION**; **CRANE CO**; **GENCOR, LTD.**; **GENERAL ELECTRIC COMPANY**; **GEORGIA-PACIFIC LLC** (*sued individually and as successor-in-interest to* BESTWALL GYPSUM COMPANY); **IMO INDUSTRIES, INC.** (*sued individually and as successor-in-interest to* DE LAVAL TURBINE, INC.) **INGERSOLL-RAND COMPANY**; **JOHN K. BICE CO., INC.**; **JOHN CRANE INC.**; **KAISER GYPSUM COMPANY, INC.**; **KELLY-MOORE PAINT COMPANY, INC.**; **M. SLAYEN AND ASSOCIATES, INC.**; **PARKER-HANNIFIN CORPORATION** (*sued individually and as successor-in-interest to* SACOMA-SIERRA, INC.); **SOCO WEST, INC.** f/k/a BRENNTAG WEST, INC. f/k/a SOCO-LYNCH CORPORATION, a/k/a SOCO-WESTERN CHEMICAL CO., a/k/a STINNES OIL & CHEMICAL COMPANY (*sued individually and as successor-in-interest to* WESTERN CHEMICAL AND MANUFACTURING COMPANY); **SYD CARPENTER, MARINE CONTRACTOR, INC.**; **UNION CARBIDE CORPORATION**; **WARREN PUMPS LLC**; **YARWAY CORPORATION**; and **DOES 1-350 INCLUSIVE** were individuals, corporations, partnerships and/or unincorporated associations organized and existing under and by virtue of the laws of the State of California, or the laws of some other state or foreign jurisdiction, and that said Defendants, and each of them, were and are authorized to do and are doing business in the State of California, or the laws of some other state or foreign jurisdiction, and that said Defendants, and each of them, were and are authorized to do and are doing business in the State of California, and that said Defendants have regularly conducted business in the County of San Diego, State of California.

FIRST CAUSE OF ACTION

(Negligence)

PLAINTIFFS COMPLAIN OF DEFENDANTS AND DOES 1-350, THEIR "ALTERNATE ENTITIES", AND EACH OF THEM, AND FOR A CAUSE OF ACTION FOR NEGLIGENCE ALLEGE AS FOLLOWS:

3. At all times herein mentioned, each of the named Defendants and DOES 1 through 350 was the successor, successor in business, successor in product line or a portion thereof, parent, subsidiary, wholly or partially owned by, or the whole or partial owner of or member in an entity researching, studying, manufacturing, fabricating, designing, modifying, labeling, assembling, distributing, leasing, buying, offering for sale, supplying, selling, inspecting, servicing, installing, contracting for installation, repairing, marketing, warranting, re-branding, manufacturing for others, packaging and advertising a certain substance, the generic name of which is asbestos, and other products containing said substance. Said entities shall hereinafter collectively be called "alternate entities." Each of the herein named Defendants is liable for the tortious conduct of each successor, successor in business, successor in product line or a portion thereof, assign, predecessor in product line or a portion thereof, parent, subsidiary, whole or partial owner, or wholly or partially owned entity, or entity that it was a member of, or funded, that researched, repaired, marketing, warranted, re-branded, manufactured for others and advertised a certain substance, the generic name of which is asbestos, and other products containing said asbestos. The following Defendants, and each of them, are liable for the acts of each and every "alternate entity", and each of them, in that there has been a virtual destruction of Plaintiffs' remedy against each such "alternate entity"; Defendants, and each of them, have acquired the assets, product line, or a portion thereof, of each such "alternate entity"; Defendants, and each of them, have caused the destruction of Plaintiffs' remedy against each such "alternate entity"; each such Defendant has the ability to assume the risk-spreading role of each such "alternate entity"; and that each such Defendant enjoys the goodwill originally attached to each such "alternate entity".

DEFENDANT	ALTERNATE ENTITY
AIR & LIQUID SYSTEMS CORPORATION	BUFFALO PUMPS, INC. BUFFALO FORGE COMPANY
ALFA LAVAL INC.	SHARPLES, INC. ALFA-LAVAL SEPARATION, INC. DeLAVAL SEPARATOR COMPANY
BRAKE GATE, LTD	SPECIAL MATERIALS, INC. – ILLINOIS SPECIAL MATERIALS, INC. – WISCONSIN SPECIAL ASBESTOS COMPANY SPECIAL MATERIALS COMPANY
CBS CORPORATION	WESTINGHOUSE ELECTRIC CORPORATION WESTINGHOUSE CREDIT CORPORATION BF STURTEVANT VIACOM INTERNATIONAL, INC. VIACOM PLUS CBS CORPORATION CBS BROADCASTING INC. (fka CBS INC.) VIACOM, INC. WESTINGHOUSE PROCESS CONTROL HAGAN CONTROL CORPORATION
CERTAINTEED CORPORATION	KEASBY & MATTISON GUSTIN BACON MANUFACTURING CO.
CRANE CO.	CRANE ENVIRONMENTAL CRANE PUMPS AND SYSTEMS VALVE SERVICES CRANE VALVE GROUP CRANE SUPPLY
GENCOR, LTD	GENERAL MINNG AND FINANCE CORPORATION GENERAL MINING SPECIAL MATERIALS, INC. – ILLINOIS SPECIAL MATERIALS, INC. – WISCONSIN SPECIAL ASBESTOS COMPANY SPECIAL MATERIALS COMPANY
GENERAL ELECTRIC COMPANY	GENERAL ELECTRIC BROADCASTING COMPANY, INC. GENERAL ELECTRIC CAPITAL ASSURANCE COMPANY GENERAL ELECTRIC PROFESSIONAL SERVICES COMPANY GENERAL ELECTRIC TRADING COMPANY
GEORGIA-PACIFIC LLC	BESTWALL GYPSUM COMPANY
IMO INDUSTRIES, INC.	DELAVAL STEAM TURBINE COMPANY

	WARREN PUMPS, INC. COLFAX CORPORATION IMO PUMP IMO AB ALLWEILER HOUTTUIN SIEMENS AG (as successor-in-interest to DEMAG DELAVAL TURBOMACHINERY CORP.) COLFAX PUMP GROUP COLFAX CORPORATION ADEL PRECISION PRODUCTS CORP
INGERSOLL-RAND COMPANY	DRESSER-RAND INGERSOLL-RAND EQUIPMENT CORPORATION INGERSOLL-RAND TRANSPORTATION SERVICES COMPANY
JOHN CRANE INC.	CRANE PACKING COMPANY TI GROUP PLC SMITHS GROUP PLC
KAISER GYPSUM COMPANY, INC.	KAISER GYPSUM COMPANY
KELLY-MOORE PAINT COMPANY, INC.	GEORGIA PACIFIC CORPORATION FRANK W. DUNNE COMPANY DUNNE QUALITY PAINTS
M. SLAYEN AND ASSOCIATES, INC.	SLAYEN & ASSOCIATES, INC. M. SLAYEN
PARKER-HANNIFIN CORPORATION	PARKER-HANNIFIN CORPORATION HANNIFIN CORPORATION SACOMA-SIERRA, INC.
SOCO WEST, INC.	BRENNTAG WEST, INC. SOCO-LYNCH CORPORATION, SOCO-WESTERN CHEMICAL CO. STINNES OIL & CHEMICAL COMPANY WESTERN CHEMICAL & MANUFACTURING COMPANY
SYD CARPENTER, MARINE CONTRACTOR, INC.	SYD CARPENTER COMPANY
UNION CARBIDE CORPORATION	THE DOW CHEMICAL COMPANY UNION CARBIDE CHEMICALS AND PLASTICS COMPANY, INC. UNION CARBIDE AND CARBON

	CORPORATION LINDE AIR PRODUCTS COMPANY NATIONAL CARBON CO., INC. PREST-O-LITE CO., INC. UNION CARBIDE COMPANY CARBIDE AND CARBON CHEMICALS CORPORATION BAKELITE COROPORATION UNION CARBIDE CONSUMER PRODUCTS CO. UNION CARBIDE MINING AND METALS DIVISION UNION CARBIDE ELECTRONICS DIVISION UNION CARBIDE HYDROCARBONS DIVISION UNION CARBIDE FERROALLOYS DIVISION JENNAT CORPORATION AMERCHOL CORPORATION UOP UCAR CARBON COMPANY UNION CARBIDE INDUSTRIAL GASES INC. PRAXAIR, INC. POLIMERI EUROPA S.r.l. ASIAN ACETYLS COMPANY, LTD. EQUATE PETROCHEMICAL COMPANY UNIVATION TECHNOLOGIES
WARREN PUMPS LLC	WARREN PUMPS, INC. WARREN PUMPS-HOUDAILLE, INC. COLFAX PUMP GROUP IMO PUMP
YARWAY CORPORATION	TYCO FLOW CONTROL, INC. TYCO INTERNATIONAL, INC. TYCO VALVES & CONTROLS, INC. YARNALL WARING CO.

4. At all times herein mentioned, Defendants, their "alternate entities", and each of them, were and are engaged in the business of researching, manufacturing, fabricating, designing, modifying, labeling, assembling, distributing, leasing, buying, offering for sale, supplying, selling, inspecting, servicing, installing, contracting for installation, repairing, marketing, warranting, re-branding, manufacturing for others, packaging, and advertising a certain substance, the generic name of which is asbestos and other products containing said substance.

5. At all times herein mentioned, Defendants, their "alternate entities", and each of them, singularly and jointly, negligently and carelessly researched, manufactured, fabricated, designed,

modified, tested or failed to test, abated or failed to abate, warned or failed to warn of the health hazards, labeled, assembled, distributed, leased, bought, offered for sale, supplied, sold, inspected, serviced, installed, contracted for installation, repaired, marketed, warranted, re-branded, manufactured for others, packaged, and advertised a certain substance, the generic name of which is asbestos, and other products and equipment containing said substance, in that said substance proximately caused personal injuries to users, consumers, workers, bystanders, and others, including the Plaintiffs herein (hereinafter collectively called "exposed persons"), while being used in a manner that was reasonably foreseeable, thereby rendering said substance unsafe and dangerous for use by the "exposed persons".

6. Defendants, their "alternate entities," and each of them, had a duty to exercise due care in the pursuance of the activities mentioned above and Defendants, and each of them, breached said duty of due care.

7. Defendants, their "alternate entities", and each of them, knew, or should have known, and intended that the aforementioned asbestos and products containing asbestos would be transported by truck, rail, ship and other common carriers, and that in the shipping process the products would break, crumble or be otherwise damaged; and/or that such products would be used for insulation, construction, plastering, fireproofing, soundproofing, automotive, aircraft and/or other applications, including, but not limited to: sawing, chipping, hammering, scraping, sanding, breaking, removal, "rip-out", and other manipulation, resulting in the release of airborne asbestos fibers, and that through such foreseeable use and/or handling "exposed persons", including Plaintiffs herein, would use or be in proximity of and exposed to said asbestos fibers.

8. Defendants, their "alternate entities", and each of them, knew, or should have known, and intended that the aforementioned asbestos and asbestos-containing products and equipment would be used or handled as specified in Exhibit "A", which is attached hereto and incorporated by reference herein, resulting in the release of airborne asbestos fibers, and that through such foreseeable use and/or

handling "exposed persons", including Plaintiffs herein, would be in proximity to and exposed to said asbestos fibers.

9. Plaintiff WILLIAM W. MANSIR has used, handled, or been otherwise exposed to asbestos and asbestos-containing products and equipment referred to herein in a manner that was reasonably foreseeable. Plaintiff WILLIAM W. MANSIR's exposure to asbestos and asbestos-containing products occurred at various locations as set forth in Exhibit "A", which is attached hereto and incorporated by reference herein.

10. As a direct and proximate result of the conduct of the Defendants, their "alternate entities", and each of them, as aforesaid, Plaintiff WILLIAM W. MANSIR's exposure to asbestos and asbestos-containing products caused severe and permanent injury to the Plaintiffs, the nature of which, along with the date of Plaintiff WILLIAM W. MANSIR's diagnosis and the date he learned such injuries were attributable to exposure to asbestos and/or asbestos-containing products, are set forth in Exhibit "B", which is attached hereto and incorporated by reference herein.

11. Plaintiffs are informed and believe, and thereon allege, that progressive lung disease, cancer and other serious diseases are caused by inhalation of asbestos fibers without perceptible trauma and that said disease results from exposure to asbestos and asbestos-containing products over a period of time.

12. Plaintiff WILLIAM W. MANSIR suffers from pleural malignant mesothelioma, caused by an exposure to asbestos and asbestos-containing products and equipment. Plaintiff WILLIAM W. MANSIR was not aware at the time of exposure that asbestos or asbestos-containing products presented any risk of injury and/or disease.

13. As a direct and proximate result of the aforesaid conduct of Defendants, their "alternate entities", and each of them, Plaintiff WILLIAM W. MANSIR has suffered, and continues to suffer, permanent injuries and/or future increased risk of injuries to his person, body and health, including, but

not limited to, throat cancer, other lung damage, and cancer, and the mental and emotional distress attendant thereto, from the effect of exposure to asbestos fibers, all to his general damage in a sum in excess of the jurisdictional limit of a limited civil case.

14. As a direct and proximate result of the aforesaid conduct of the Defendants, their "alternate entities", and each of them, Plaintiff WILLIAM W. MANSIR has incurred, is presently incurring, and will incur in the future, liability for physicians, surgeons, nurses, hospital care, medicine, hospices, X-rays and other medical treatment, the true and exact amount thereof being unknown to Plaintiffs at this time, and Plaintiffs pray leave to amend this complaint accordingly when the true and exact cost thereof is ascertained.

15. As a further direct and proximate result of the said conduct of the Defendants, their "alternate entities", Plaintiffs have incurred, and will incur, loss of income, wages, profits and commissions, a diminishment of earning potential, and other pecuniary losses, the full nature and extent of which are not yet known to Plaintiffs; and leave is requested to amend this complaint to conform to proof at the time of trial.

16. Defendants, their "alternate entities", and each of them, and their officers, directors, and managing agents participated in, authorized, expressly and impliedly ratified, and had full knowledge of, or should have known of, each of the acts set forth herein.

17. Defendants, their "alternate entities", and each of them, are liable for the fraudulent, oppressive, and malicious acts of their "alternate entities", and each of them, and each Defendants' officers, directors, and managing agents participated in, authorized, expressly and impliedly ratified, and had full knowledge of, or should have known of, the acts of each of their "alternate entities" as set forth herein.

18. The herein-described conduct of said Defendants, their "alternate entities", and each of them, was and is willful, malicious, fraudulent, outrageous, and in conscious disregard and indifference

to the safety and health of "exposed persons". Plaintiffs, for the sake of example and by way of punishing said Defendants, seek punitive damages according to proof.

WHEREFORE, Plaintiffs pray for judgment against Defendants, their "alternate entities", and each of them, as hereinafter set forth.

SECOND CAUSE OF ACTION

(Strict Liability)

AS AND FOR A SECOND, SEPARATE, FURTHER AND DISTINCT CAUSE OF ACTION FOR STRICT LIABILITY, PLAINTIFFS COMPLAIN OF DEFENDANTS, DOES 1-350, THEIR "ALTERNATE ENTITIES", AND EACH OF THEM, AND ALLEGE AS FOLLOWS:

19. Plaintiffs incorporate herein by reference, as though fully set forth therein, the allegations contained in the First Cause of Action herein.

20. Defendants, their "alternate entities", and each of them, knew and intended that the above-referenced asbestos and asbestos-containing products would be used by the purchaser or user without inspection for defects therein or in any of their component parts and without knowledge of the hazards involved in such use.

21. Said asbestos and asbestos-containing products were defective and unsafe for their intended purpose in that the inhalation of asbestos fibers causes serious disease and/or death. The defect existed in the said products at the time they left the possession of the Defendants, their "alternate entities," and each of them. Said products did, in fact, cause personal injuries, including asbestosis, other lung damage, and cancer to "exposed persons", including Plaintiff WILLIAM W. MANSIR herein, while being used in a reasonably foreseeable manner, thereby rendering the same defective, unsafe, and dangerous for use.

22. At all times mentioned herein, the above-referenced asbestos and asbestos-containing products failed to perform as safely as an ordinary consumer and/or other "exposed persons" would expect when used in an intended or reasonably foreseeable manner, and/or the risk of danger inherent in this substance and products outweighed the benefits of said substance and products.

23. At all times mentioned herein, the foreseeable use of said asbestos and asbestos-containing products involved a substantial danger not readily recognizable to an ordinary user, consumer, or bystander, or other "exposed persons," but which danger was known or knowable to Defendants, and Defendants failed to adequately warn of the substantial danger.

24. "Exposed persons" did not know of the substantial danger of using said products. Said dangers were not readily recognizable by "exposed persons". Said Defendants, their "alternate entities", and each of them, further failed to adequately warn of the risks to which Plaintiff WILLIAM W. MANSIR and others similarly situated were exposed.

25. In researching, manufacturing, fabricating, designing, modifying, testing, or failing to test, warning or failing to warn, labeling, assembling, distributing, leasing, buying, offering for sale, supplying, selling, inspecting, servicing, installing, contracting for installation, repairing, marketing, warranting, re-branding, manufacturing for others, packaging, and advertising asbestos and asbestos-containing products and equipment, Defendants, their "alternate entities", and each of them, did so with conscious disregard for the safety of "exposed persons" who came in contact with said asbestos and asbestos-containing products, including, but not limited to, asbestosis, other lung damages, and cancer. Said knowledge was obtained, in part, from scientific studies performed by, at the request of, or with the assistance of, said Defendants, their "alternate entities", and each of them, on or before 1930, and thereafter.

26. On or before 1930, and thereafter, said Defendants, their "alternate entities" and each of them, were aware that members of the general public and other "exposed persons", who would come in contact with their asbestos and asbestos-containing products, had no knowledge or information indicating that asbestos or asbestos-containing products could cause injury, and said Defendants, their "alternate entities", and each of them, knew that members of the general public, and other "exposed persons", who came in contact with asbestos and asbestos-containing products, would assume, and in

fact did assume, that exposure to asbestos and asbestos-containing products was safe, when in fact said exposure was extremely hazardous to health and human life.

27. With said knowledge, said Defendants, their "alternate entities", and each of them, opted to research, manufacture, fabricate, design, modify, label, assemble, distribute, lease, buy, offer for sale, supply, sell, inspect, service, install, contract for installation, repair, market, warrant, re-brand, manufacture for others, package, and advertise said asbestos and asbestos-containing products without attempting to protect "exposed persons" from, or warn "exposed persons" of, the high risk of injury or death resulting from exposure to asbestos and asbestos-containing products. Rather than attempting to protect "exposed persons" from, or warn "exposed persons" of, the high risk of injury or death resulting from exposure to asbestos and asbestos-containing products, Defendants, their "alternate entities", and each of them, intentionally failed to reveal their knowledge of said risk, failed to warn of said risk and consciously and actively concealed and suppressed said knowledge from "exposed persons" and members of the general public, thus impliedly representing to "exposed persons" and members of the general public that asbestos and asbestos-containing products were safe for all reasonably foreseeable uses. Defendants, their "alternate entities", and each of them, engaged in this conduct and made these implied representations with the knowledge of the falsity of said implied representations.

28. The above-referenced conduct of said Defendants, their "alternate entities", and each of them, was motivated by the financial interest of said Defendants, their "alternate entities", and each of them, in the continuing, uninterrupted research, design, modification, manufacture, fabrication, labeling, assembly, distribution, lease, purchase, offer for sale, supply, sale, inspection, installation, contracting for installation, repair, marketing, warranting, re-branding, manufacturing for others, packaging and advertising of asbestos and asbestos-containing products. In pursuance of said financial motivation, Defendants, their "alternate entities", and each of them, consciously disregarded the safety of "exposed persons" and in fact were consciously willing and intended to permit asbestos and asbestos-containing

products to cause injury to "exposed persons" and induced persons to work with and be exposed thereto, including Plaintiff WILLIAM W. MANSIR

29. Plaintiffs allege that the aforementioned Defendants, their "alternate entities", and each of them, impliedly warranted their asbestos and asbestos-containing products and equipment to be safe for their intended use, but their asbestos and asbestos-containing products created an unreasonable risk of bodily harm to Plaintiff WILLIAM W. MANSIR.

30. Plaintiffs further allege that Plaintiff WILLIAM W. MANSIR's injuries are a result of cumulative exposure to asbestos and various asbestos-containing products and equipment manufactured, fabricated, inadequately researched, designed, modified, inadequately tested, labeled, assembled, distributed, leased, brought, offered for sale, supplied, sold, inspected, serviced, installed, contracted for installation, repaired, marketed, warranted, re-branded, manufactured for others, packaged and advertised by the aforementioned Defendants, their "alternate entities", and each of them, all of which were a substantial contributing factor to Plaintiff's development of the asbestos disease complained of herein. Among the injurious exposures alleged herein are Plaintiff WILLIAM W. MANSIR's exposures to asbestos supplied with, affixed and/or added to, and/or installed on the following equipment aboard Plaintiff's U.S. Naval vessels: DeLaval purifiers, Sharples purifiers, Buffalo pumps, Westinghouse turbines and draft blowers, Crane valves, General Electric turbines and generators, Ingersoll-Rand pumps and compressors, Warren pumps and Yarway valves and steam traps.

31. Plaintiff WILLIAM W. MANSIR relied upon Defendants, their "alternate entities", and each of their representations, lack of warnings, and implied warranties of the fitness of asbestos and asbestos-containing products. As a direct, foreseeable, and proximate result thereof, Plaintiffs have been injured permanently as alleged herein.

32. As a direct and proximate result of the actions and conduct outlined herein, Plaintiff WILLIAM W. MANSIR has suffered the injuries and damages alleged herein.

WHEREFORE, Plaintiffs pray for judgment against Defendants, and their "alternate entities", and each of them, as hereinafter set forth.

THIRD CAUSE OF ACTION

(False Representation Under Restatement of Torts Section 402-B)

AS AND FOR A FURTHER, THIRD, SEPARATE AND DISTINCT CAUSE OF ACTION FOR FALSE REPRESENTATION UNDER RESTATEMENT OF TORTS SECTION 402-B, PLAINTIFFS COMPLAIN OF DEFENDANTS, DOES 1-350, THEIR "ALTERNATE ENTITIES", AND EACH OF THEM, AND ALLEGE AS FOLLOWS:

33. Plaintiffs hereby incorporate by reference, as though fully set forth herein, each and every allegation contained in the First and Second Causes of Action.

34. At the aforementioned time when Defendants, their "alternate entities", and each of them, researched, manufactured, fabricated, designed, modified, tested or failed to test, inadequately warned or failed to warn, labeled, assembled, distributed, leased, bought, offered for sale, supplied, sold, inspected, serviced, installed, contracted for installation, repaired, marketed, warranted, re-branded, manufactured for others, packaged and advertised the said asbestos and asbestos-containing products, as hereinabove set forth, the Defendants, their "alternate entities", and each of them, expressly and impliedly represented to members of the general public, including the purchasers and users of said product, and other "exposed persons", including, without limitation, Plaintiff WILLIAM W. MANSIR and his employers, that asbestos and asbestos-containing products, were of merchantable quality, and safe for the use for which they were intended.

35. The purchasers and users of said asbestos and asbestos-containing products, and other "exposed persons", including, without limitation, Plaintiff WILLIAM W. MANSIR, and his employers, relied upon said representations of Defendants, their "alternate entities", and each of them, in the selection, purchase, and use of asbestos and asbestos-containing products.

36. Said representation by Defendants, their "alternate entities", and each of them, were false and untrue, and Defendants knew at the time they were untrue, in that the asbestos and asbestos-

containing products and equipment were not safe for their intended use, nor were they of merchantable quality as represented by Defendants, their "alternate entities", and each of them, in that asbestos and asbestos-containing products and equipment have very dangerous properties and defects whereby said products cause asbestosis, other lung damages, and cancer, and have other defects that cause injury and damage to the users of said products and other "exposed persons", thereby threatening the health and life of said persons, including Plaintiff WILLIAM W. MANSIR herein.

37. As a direct and proximate result of said false representations by Defendants, their "alternate entities", and each of them, Plaintiffs sustained the injuries and damages alleged herein.

WHEREFORE, Plaintiffs pray for judgment against Defendants, their "alternate entities", and each of them, as hereinafter set forth.

FOURTH CAUSE OF ACTION

(Intentional Tort/Intentional Failure to Warn)

AS AND FOR A FURTHER, FOURTH, SEPARATE AND DISTINCT CAUSE OF ACTION FOR AN INTENTIONAL TORT UNDER CIVIL CODE SECTIONS 1708 THROUGH 1710, PLAINTIFFS COMPLAIN OF DEFENDANTS, DOES 1-350, THEIR "ALTERNATE ENTITIES", AND EACH OF THEM, AND ALLEGE:

38. Plaintiffs hereby incorporate by reference, as though fully set forth herein, each and every allegation contained in the First and Third Causes of Action herein, excepting there from allegations pertaining to negligence.

39. At all times pertinent hereto, the Defendants, their "alternate entities", and each of them, owed Plaintiffs a duty, as provided for in Section 1708, 1709, and 1710 of the Civil Code of the State of California, to abstain from injuring the person, property, or rights of the Plaintiffs. When a duty to act was imposed, as set forth herein, the Defendants, their "alternate entities", and each of them, did do the acts and omissions in violation of that duty, thereby causing injury to the Plaintiffs as is more fully set forth herein. Such acts and omissions consisted of acts falling within Section 1709 (Fraudulent Deceit) and Section 1710 (Deceit) of the Civil Code of the State of California and, more specifically, included

suggestions of fact which were not true and which Defendants, their "alternate entities", and each of them, did not believe to be true; assertions of fact which were not true and which Defendants, their "alternate entities", and each of them, had no reasonable ground for believing to be true, and the suppression of fact when a duty existed to disclose it, all as more fully set forth herein; the violation of any one such duty gave rise to a cause of action for violation of rights of the Plaintiffs as provided for in the aforementioned Civil Code sections.

40. Since on or before 1930, the Defendants, their "alternate entities", and each of them, have known and have possessed the true facts of medical and scientific data and other knowledge which clearly indicated that the asbestos and asbestos-containing products and equipment referred to in Plaintiffs' First Cause of Action were and are hazardous to the health and safety of Plaintiffs, and others in Plaintiff WILLIAM W. MANSIR's position working in close proximity with such materials. The Defendants, their "alternate entities", and each of them, have known of the dangerous propensities of the aforementioned materials and products since before that time. With intent to deceive Plaintiff WILLIAM W. MANSIR, and others in Plaintiff's position, and with intent that he and such others should be and remain ignorant of such facts with intent to induce Plaintiffs and such others to alter his and their positions to his and their injury and/or risk and in order to gain advantages, the following acts occurred:

(a) Defendants, their "alternate entities", and each of them, did not label any of the aforementioned asbestos-containing materials, products, and equipment regarding the hazards of such materials and products to the health and safety of Plaintiffs and others in Plaintiffs' position working in close proximity with such materials until 1964, when certain of such materials were labeled by some, but not all, of Defendants, their "alternate entities", and each of them, since on or before 1930. By not labeling such materials, products, and equipment as to their said hazards, Defendants, their "alternate entities", and each of them, caused to be suggested as a fact to Plaintiffs that it was safe for Plaintiff WILLIAM W. MANSIR to work in close proximity to

such materials, when in fact it was not true; and Defendants, their "alternate entities", and each of them, did not believe it to be true;

(b) Defendants, their "alternate entities", and each of them, suppressed information relating to the danger of use of the aforementioned materials, products, and equipment by requesting the suppression of information to the Plaintiffs and the general public concerning the dangerous nature of the aforementioned materials to workers, by not allowing such information to be disseminated in a manner which would have given general notice to the public and knowledge of the hazardous nature thereof when Defendants, their "alternate entities", and each of them, were bound to disclose such information;

(c) Defendants, their "alternate entities", and each of them, sold the aforementioned products, materials, and equipment to Plaintiff WILLIAM W. MANSIR's employers and others without advising Plaintiff WILLIAM W. MANSIR, his employer, and others of the dangers of use of such materials to persons working in close proximity thereto when Defendants, their "alternate entities", and each of them, knew of such dangers, and had a duty to disclose such dangers all as set forth herein. By said conduct, Defendants, their "alternate entities", and each of them, caused to be positively asserted to Plaintiff WILLIAM W. MANSIR that which was not true and that which Defendants, their "alternate entities," and each of them had no reasonable ground for believing to be true, to wit: that it was safe for Plaintiff WILLIAM W. MANSIR to work in close proximity to such materials;

(d) Defendants, their "alternate entities", and each of them, suppressed from Plaintiffs medical and scientific data and knowledge of the results of studies including, but not limited to, the information and contents of the "Lanza Report." Although bound to disclose it, Defendants, their "alternate entities", and each of them, influenced A. J. Lanza, M.D. to change his report, the altered version of which was published in Public Health Reports, Volume 50, at page 1, in 1935, thereby causing Plaintiffs and others to be and remain ignorant thereof. Defendants, their "alternate entities", and each of them, caused Asbestos Magazine, a widely disseminated trade journal, to omit mention of danger, thereby lessening the probability of notice of danger to the users thereof;

(e) Defendants, their "alternate entities", and each of them, belonged to, participated in, and financially supported the Asbestos Textile Institute Industrial Hygiene Foundation and other industry organizations which, for and on behalf of Defendants, their "alternate entities", and each of them, actively promoted the suppression of information of danger to users of the aforementioned products and materials, thereby misleading Plaintiff WILLIAM W. MANSIR by the suggestions and deceptions set forth above in this cause of action. The Dust Control Committee, which changed its name to the Air Hygiene Committee, of the Asbestos Textile Institute, was specifically enlisted to study the subject of dust control. Discussions in this committee were held many times regarding the dangers inherent in asbestos and the dangers, which arise from the lack of control of dust, and such information was suppressed from public dissemination from 1946 to a date unknown to Plaintiffs at this time;

(f) Commencing in 1930 with the study of mine and mill workers at Asbestos and Thetford Mines in Quebec, Canada, and the study of the workers at Raybestos-Manhattan plants in Manheim and Charleston, South Carolina, Defendants, their "alternate entities", and each of them, knew and possessed medical and scientific information of the connection between the inhalation of asbestos fibers and asbestosis, which information was disseminated through the Asbestos Textile Institute and other industry organizations to all other Defendants, their "alternate entities", and each of them, herein. Between 1942 and 1950, the Defendants, their "alternate entities", and each of them, suggested to the public as a fact that which is not true and disseminated other facts likely to mislead Plaintiffs. Such facts did mislead Plaintiffs and others by withholding the afore-described medical and scientific data and other knowledge and by not giving Plaintiff WILLIAM W. MANSIR the true facts concerning such knowledge of danger, which Defendants, their "alternate entities", and each of them, were bound to disclose;

(g) Defendants, their "alternate entities", and each of them, failed to warn Plaintiff WILLIAM W. MANSIR and others of the nature of said materials which were dangerous when breathed and which could cause pathological effects without noticeable trauma, despite the fact that Defendants, their "alternate entities", and each of them, possessed knowledge and were under a duty to disclose that said materials were dangerous and a threat to the health of persons

coming into contact therewith;

(h) Defendants, their "alternate entities", and each of them, failed to provide Plaintiff WILLIAM W. MANSIR with information concerning adequate protective masks and other equipment devised to be used when applying and installing the products of the Defendants, their "alternate entities", and each of them, despite knowing that such protective measures were necessary, and that they were under a duty to disclose that such materials were dangerous and would result in injury to Plaintiff WILLIAM W. MANSIR and others applying and installing such material;

(i) Defendants, their "alternate entities", and each of them, when under a duty to so disclose, concealed from Plaintiff WILLIAM W. MANSIR the true nature of the industrial exposure of Plaintiff WILLIAM W. MANSIR and knew that Plaintiff and anyone similarly situated, upon inhalation of asbestos would, in time, develop irreversible conditions of pneumoconiosis, asbestosis, and/or cancer. Defendants, their "alternate entities", and each of them, also concealed from Plaintiff WILLIAM W. MANSIR and others that harmful materials to which they were exposed would cause pathological effects without noticeable trauma;

(j) Defendants, their "alternate entities", and each of them, failed to provide information of the true nature of the hazards of asbestos materials and that exposure to these material would cause pathological effects without noticeable trauma to the public, including buyers, users, and physicians employed by Plaintiff WILLIAM W. MANSIR so that said physicians could not examine, diagnose, and treat Plaintiffs and others who were exposed to asbestos, despite the fact that Defendants, their "alternate entities", and each of them, were under a duty to so inform and said failure was misleading; and

(k) Defendants, their "alternate entities", and each of them, failed to provide adequate information to physicians and surgeons retained by Plaintiff WILLIAM W. MANSIR's employers and their predecessor companies, for purposes of making physical examinations of Plaintiff WILLIAM W. MANSIR and other employees as to the true nature and risk of such materials and exposure thereto when they in fact possessed such information and had a duty to disclose it.

41. Defendants, their "alternate entities", and each of them, willfully failed and omitted to complete and file a First Report of Occupational Injury or Illness regarding Plaintiffs' injuries, as required by law, and did willfully fail and omit to file a Report of Injury and Occupational Disease with the State of California. Plaintiff WILLIAM W. MANSIR was in the class of persons with respect to whom a duty was owed to file such reports and who would have been protected thereby if the fact of danger from products complained of had become known.

42. Defendants, their "alternate entities", and each of them, having such aforementioned knowledge, and the duty to inform Plaintiff WILLIAM W. MANSIR about the true facts, and knowing the Plaintiff WILLIAM W. MANSIR did not possess such knowledge and would breathe such material innocently, acted falsely and fraudulently and with full intent to cause Plaintiff WILLIAM W. MANSIR to remain unaware of the true facts and to induce Plaintiff WILLIAM W. MANSIR to work in a dangerous environment, all in violation of Sections 1708, 1709, and 1710 of the Civil Code of the State of California.

43. As a direct and proximate result of such intentional conduct by Defendants, their "alternate entities" and each of them, Plaintiff WILLIAM W. MANSIR sustained the injuries and damages alleged herein. The herein-described conduct of said Defendants, their "alternate entities", and each of them was and is willful, malicious, fraudulent, outrageous, and in conscious disregard and indifference to the safety and health of "exposed persons". Plaintiffs, for the sake of example and by way of punishing said Defendants, seek punitive damages according to proof.

WHEREFORE, Plaintiffs pray for judgment against Defendants, their "alternate entities," and each of them, as is hereinafter set forth.

FIFTH CAUSE OF ACTION

(Loss of Consortium)

AS AND FOR A FURTHER, SIXTH SEPARATE, AND DISTINCT CAUSE OF ACTION FOR LOSS OF CONSORTIUM, PLAINTIFF TERI M. MANSIR COMPLAINS OF DEFENDANTS, DOES 1-350,

THEIR "ALTERNATE ENTITIES", AND EACH OF THEM, AND ALLEGES AS FOLLOWS:

44. Plaintiff TERI M. MANSIR incorporates by reference, each and every paragraph of the First through Fourth Causes of Action herein.

45. Plaintiffs WILLIAM W. MANSIR and TERI M. MANSIR were married on April 8, 1989, and at all times relevant to this action were, and are now, husband and wife.

46. Prior to Plaintiff WILLIAM W. MANSIR's injuries as alleged, he was able and did perform duties as a spouse. Subsequent to the injuries and as a proximate result thereof, Plaintiff WILLIAM W. MANSIR has been unable to perform the necessary duties as a spouse and the work and services usually performed in the care, maintenance, and management of the family home, and he will be unable to perform such work, service and duties in the future. As a proximate result thereof, TERI M. MANSIR has been permanently deprived and will be deprived of the consortium of her spouse, including the performance of duties, all to his damages, in an amount presently unknown but which will be proved at the time of trial.

47. Plaintiff TERI M. MANSIR's discovery of this cause of her loss of consortium, as herein alleged, first occurred within one year of the date this Complaint was filed.

48. As a direct and proximate result of the acts of Defendants, their "alternate entities", and each of them, and the severe injuries caused thereby to Plaintiff WILLIAM W. MANSIR, as set forth in this complaint, Plaintiff TERI M. MANSIR has suffered, and for a long period of time will continue to suffer, loss of consortium, including, but not limited, loss of services, marital relations, society, comfort, companionship, love and affection of said spouse, and has suffered severe mental and emotional distress and general nervousness as a result thereof.

WHEREFORE, Plaintiffs pray for judgment against Defendants, their "alternate entities," and each of them, as is hereinafter set forth.

WHEREFORE, Plaintiffs prays for judgment against Defendants, their "alternate entities", and each of them, in an amount to be proved at trial in each individual case, as follows:

Plaintiff WILLIAM W. MANSIR:

1. For Plaintiff's general damages according to proof;

2. For Plaintiff's loss of income, wages, and earning potential according to proof;

3. For Plaintiff's medical and related expenses according to proof;

Plaintiff TERI M. MANSIR:

4. For Plaintiff's damages for loss of consortium and/or society according to proof.

Plaintiffs WILLIAM W. MANSIR and TERI M. MANSIR:

5. For Plaintiffs' cost of suit herein;

6. For exemplary or punitive damages according to proof;

7. For damages for fraud according to proof; and

8. For such other and further relief as the Court may deem just and proper, including costs and prejudgment interest as provided in C.C.P. section 998, C.C.P. section 1032, and related provisions of law.

DATED: November 11, 2010

WATERS, KRAUS & PAUL

By: _____
MICHAEL W. ARMITAGE
Attorneys for Plaintiffs

Exhibit 2

William W. Mansir, et al. v. Air & Liquid Systems Corporation, et al.
Case No. 37-2010-00104112-CU-AS-CTL
Superior Court of the State of California. County of San Diego

AFFIDAVIT OF ROGER B. HORNE, JR.

STATE OF WASHINGTON)
) SS.
COUNTY OF KITSAP)

I, Roger B. Horne, Jr., being under penalty of perjury, declare and say:

1. I am a retired Rear Admiral of the United States Navy, in which I served between 1956 and 1991. A copy of my curriculum vitae is attached as Exhibit A and my relevant work history and experience are discussed below.

2. I began my Navy career in 1956, immediately after receiving a Bachelor of Science degree in Naval Engineering from the United States Naval Academy at Annapolis, Maryland. I have also received extensive post-graduate education in naval engineering, including a Master of Science Degree in Mechanical Engineering from the U.S. Naval Postgraduate School, and have taught Naval Engineering as a Visiting Professor at the University of Michigan. Throughout my Navy career, I concentrated in areas of ship design, engineering, construction, overhaul and inspection. Ultimately, I achieved the rank of Chief Engineer and Deputy Commander, Naval Sea Systems Command ("NAVSEA") for Ship Design and Engineering. Prior to that, I served as Deputy Commander, NAVSEA for Facilities and Industrial Management; Commander, Puget Sound Naval Shipyard: Commander, Engineering Duty Officer School; Production and Repair Officer, Mare Island Naval Shipyard: Nuclear Engineering Manager, Puget Sound Naval Shipyard; Nuclear Submarine Inspection Officer, Supervisor of Shipbuilding Office. Ingalls Shipyard and Chief Engineer on the *USS Osborn* (DD846).

3. During my time in the Navy, I was also responsible for maintaining naval ship military specifications and for monitoring compliance with the specifications by all vendors

and contractors of naval equipment. Military specifications ("MilSpecs") were applicable to equipment manufacturers, including pump manufacturers like Buffalo Pumps, Inc. ("Buffalo Pumps"). Equipment manufacturers, Naval Machinery Inspectors and others relied on these MilSpecs to ensure strict compliance with NAVSEA demands and requirements for combat-ready vessels.

4. In addition to my training and experience in Navy ship construction, as outlined above, I have been recognized for achievements in the field of marine machinery and engineering, and have received three Navy Legion of Merit Awards and three Meritorious Service Awards for Engineering and Industrial Achievement and an award from the Marine Machinery Association.

5. Based on my experience, I can attest to the level of supervision, direction and control exercised by the Navy over the design and manufacture of equipment, including centrifugal pumps and related equipment, intended for installation on Navy vessels. In addition, I have personal knowledge of the comprehensive plans, specifications and requirements which governed suppliers like Buffalo Pumps of equipment for use aboard Navy ships. More particularly, I can attest that any and all work performed on pumps built and supplied for these ships by vendors such as Buffalo Pumps was performed to the requirements specified by the Navy, and that the work was reviewed and inspected by Navy personnel in the vendor's plant and in the shipbuilding yards. In many instances during my career I personally inspected equipment, including pumps, to verify conformance with the requirements specified, although more immediate supervision typically was exercised by officers and other Navy personnel under my command or the command of NAVSEA or its predecessor, the Bureau of Ships ("BUSHIPS").

6. The Navy chain of command concerning ship construction involves several layers of authority related to technical and contractual control over Navy shipbuilding. The Secretary of the Navy has ultimate authority over the Navy and Navy shipbuilding; immediately below the Secretary, as has been the case since the creation of NAVSEA, is the

Chief of Naval Operations ("CNO"), to whom NAVSEA reports. Prior to the establishment of NAVSEA, BUSHIPS controlled all combat ship design and construction and reported to the CNO as well as a civilian Assistant Secretary. Since the creation of NAVSEA, NAVSEA reports to the CNO for all military ship design and construction.

7. Under the command of NAVSEA, as was the case with BUSHIPS, the Navy's shipbuilding structure was comprised of several divisions and levels of authority concerning ship design, construction, repair and inspection. Technical and contractual control over shipboard equipment and material was directed by the Commander of Naval Sea Systems and the Commander of Naval Supply. Each of these two organizations had oversight responsibility concerning, among other things, pumps built for Navy vessels. Compliance with the standards and specifications required for pumps built for Navy use was directly monitored by Naval Machinery Inspectors under both of these divisions: the Machinery Inspectors under Naval Supply worked on-site at the vendor's (in this case Buffalo Pumps') manufacturing facility, and the Machinery Inspectors under Naval Sea Systems Commands carried out their responsibilities at the shipbuilding yards. Moreover, it was common in my experience for Directors of the Machinery and Propulsion Equipment Groups, who worked for me at times during my career, to inspect the manufacturing process at vendors' plants.

8. The Machinery Inspectors exercised primary, front-line control over the work performed for the Navy by vendors such as Buffalo Pumps in the production of pumps and other equipment. The Naval Machinery Inspectors were responsible for assuring that contractors such as Buffalo Pumps followed the required contract specifications as they relate to naval machinery. Further, the Naval Machinery Inspectors would report to their superiors any violations or failures to comply with specifications.

9. Specifications for Naval ships and their equipment require special characteristics necessary to satisfy reliability in combat situations and during long intervals at sea. Naval ships and equipment are maintained with parts from a naval supply system that provides spare parts and proven consumables aboard ship and at stock points in remote

geographic locations. The problem of maintenance support is made more complex by the fact there are hundreds of naval ships. For these reasons the Navy cannot tolerate variations in its equipment or the parts and consumables associated with them. Any deviation from equipment military specifications requires specific written approval from the Navy. The Navy must know that the design and material that goes into its ships and equipment are in strict adherence to specifications — without this assurance we would not have a reliable and serviceable Navy.

10. Pumps built for Navy vessels, including Buffalo Pumps' pumps, were manufactured according to detailed specifications prepared, written and issued exclusively by, and plans approved by, the Navy, specifically NAVSEA or BUSHIPS. In my role as Chief Engineer and Deputy Commander for NAVSEA's Ship Design and Engineering Division, I was personally responsible to the Commander of NAVSEA for developing ship designs and for overall technical support to the operating fleet, maintenance of ships, and ships under construction. I was also responsible for maintaining naval ship military specifications and for monitoring compliance with the specifications by all vendors and contractors of naval equipment.

11. MilSpecs for pumps and other equipment intended for use aboard Navy vessels were drafted, approved and maintained by the Navy, specifically NAUSEA, to address all aspects of shipboard equipment and materials requirements, including the materials to be used. Any changes to these specifications were made by the Navy. NAVSEA maintained and controlled the MilSpecs largely because it had superior knowledge of the demands and requirements of combat-ready vessels. NAVSEA or BUSHIPS also prepared contract specifications which incorporated the MilSpecs. These specifications reflected the state of the art and the special needs of combat vessels destined for combat with our sailors. They were communicated to pump vendors such as Buffalo Pumps when the Navy issued Requests for Proposal for shipboard equipment. The specifications covered the nature of any communication affixed to pumps or other equipment supplied to the Navy.

12. The Navy retained the final say over the design of any piece of equipment, and made the ultimate decision regarding how to resolve an engineering disagreement between the Navy and an outside supplier. Without prior discussion, approval and acceptance by the Navy, a warning related to asbestos hazards would not have been permitted.

13. In addition to specifications regarding design and manufacturing of the equipment itself, the Navy also had detailed specifications that governed the form and content of written materials to be delivered with equipment, including pumps, supplied to the Navy. These written materials typically consisted of technical or instruction manuals that were designed to assist the Navy engineering staff in servicing and maintaining the equipment. Navy personnel participated in and approved the preparation of this kind of information. The Navy specifications for these manuals contained detailed direction as to the kinds of information to be included.

14. I am familiar with the MilSpecs and other specifications governing the preparation of technical manuals for machinery and equipment supplied to the Navy. Exemplars of these specifications — 35B2(SHIPS) (15 Feb. 1949); MIL-T-15071B (16 Aug. 1954); and MIL-M15071D(SHIPS) (6 June 1961) — are attached as Exhibits B, C and D. These specifications did not require manufacturers of Naval equipment, such as pumps, to include warnings pertaining to potential asbestos hazards. Indeed, for the reasons already discussed above, a manufacturer such as Buffalo Pumps would not have been permitted to include a warning regarding asbestos in an equipment manual or on a product label. The Navy's detailed specifications did not leave room for individual manufacturers to make determinations about the inclusion of a warning.

15. As a consequence of the foregoing, all equipment, including pumps supplied by Buffalo Pumps for use aboard Navy vessels were manufactured pursuant to Navy specifications under close supervision by personnel employed by the Navy, and approved for installation aboard these vessels exclusively by the Navy and its designated officers. Any warning purportedly required by state law would not have found its way into a ship as a

permanent label on a pump or as a warning in accompanying written materials unless it had been required specifically in the specifications for the product that were issued by the Navy.

16. The Navy had state of the art knowledge regarding the potential risks associated with exposure to asbestos and asbestos-containing products. Acting with this knowledge about asbestos-related hazards, the Navy affirmatively addressed the issue of asbestos-related safety precautions. As noted above, the Navy established its MilSpecs to account for the safety precautions it deemed appropriate.

17. The Navy maintained a Medical Department, which had the mission of "promotion of physical fitness; prevention and control of diseases and injuries; and treatment and care of the sick and injured." As explained in *The Human Machine: Biological Science for the Armed Services,* a 1955 Naval Institute textbook that was incorporated into the curriculum during my time at the United States Naval Academy, "in order to fulfill [its] responsibility[,] the Medical Department is actively concerned with all phases of life in the Navy and advises all components of the Navy on matters which may affect the health and well-being of naval personnel." (Exhibit E, p. 275.)

18. The Navy Medical Department maintained a central administrative organization known as the Bureau of Medicine and Surgery ("BUMED"). Among BUMED's many functions was a responsibility to conduct research to "assist in the development of new equipment, new and better methods of care and treatment of various diseases and injuries; help in the problem of adjustment of naval personnel to all of the new and strange environmental situations in which they are placed; and, in general, provide the knowledge necessary for the more efficient operation of the Navy. BUMED's research was "extremely broad and parallels the total activity of the Navy." (Exhibit E, p. 277.)

19. In dealing with asbestos, the Navy also conducted its own training, adopted its own precautionary measures and procedures and provided its own warnings where such warnings were deemed appropriate. For example, a 1950 General Safety Rules Manual issued by the Puget Sound Naval Shipyard instructed workers to "[w]ear dust type or air-fed

respirators for . . handling amosite [asbestos] insulating materials. . . ." (Exhibit F, p. 31.) A 1961 Marine Pipe Covering and Insulating Manual for Puget Sound similarly set forth "General Safety and Health Practices," including instructions to "[h]andle amosite . . . materials carefully to avoid [its] dust[]," "sprinkle amosite with water whenever possible to keep dust down," and "[s]ee that your chest is X-rayed at least once a year to detect the possibility of . . . asbestosis." (Exhibit G. pp. 25-26.) Notably, the basic Naval Academy textbook *The Human Machine* referenced above discussed the fact that "[t]here are *dusts* and *vapors* which cause injury and occasionally death. For example, dust causes such diseases as silicosis, anthracosis, and other diseases due to the inhalation of such materials as asbestos dust, iron dust, tobacco dust, etc." (Exhibit E, pp. 85- 86).

20. In November 1970, the Hygiene Division of the Medical Department at Puget Sound issued a manual pertaining specifically to "Asbestos Exposure and Control" (Exhibit H), which presented "Clinical & Environmental Findings" of a study done in connection with the shipyard's occupational health program, comparing the incidence of lung abnormalities across various occupation groups in the shipyard, and assessing the effectiveness of control measures used by the Navy. The manual also recommended control methods designed to reduce asbestos-related health hazards, including use of respirators and protective clothing, ventilation controls, substitution of asbestos-containing materials, changes in work practices (such as wetting of asbestos-containing materials during installation and removal), and implementation of education programs designed to reduce the incidence of asbestos-related illnesses.

21. In February 1971, NAVSHIPS issued Instruction 5100.26 (Exhibit I), providing a clear example of the Navy's having taken affirmative steps to implement a detailed and comprehensive plan for controlling asbestos hazards. This document set forth dozens of steps to be taken to reduce or eliminate exposure to asbestos from materials in use aboard Navy vessels and in other Navy facilities. Additional instructions were issued thereafter by various Navy departments as the Navy continued to refine its procedures for

handling of asbestos-containing materials and preventing asbestos exposures.

22. In my experience, and as evidenced by the documents described above, the Navy relied on training and procedures to protect its personnel against safety hazards such as asbestos. The Navy believed that excessive warnings for common shipboard hazards led to apathy and resulting disregard of hazard by Navy personnel. Thus, the Navy would not have permitted (either under the specifications or, as a matter of Navy practice) a vendor such as Buffalo Pumps to attach any type of warning or cautionary statement not required and approved by the Navy, including any statements related to asbestos. Any attempt by a manufacturer to affix a cautionary statement concerning asbestos to pumps would have been futile, and would have been contrary to Navy protocols for instruction and training relating to use of asbestos materials.

23. The Navy's view that issues such as asbestos exposure were inappropriate subjects of warnings on pumps or in documentation relating to them is exemplified by the manner in which the Navy chose to handle the hazards of asbestos. Rather than placing warning labels on, for example, thousands of feet of piping hundreds of pieces of equipment, the Navy instituted procedures and training designed to educate its personnel in what the Navy determined to be appropriate work practices. Even in the case of insulation, the Navy did not place warnings on "packages."

ROGER B. HORNE, JR.

William W. Mansir, et al. v. Air & Liquid Systems Corporation, et al.
Case No. 37-2010-00104112-CU-AS-CTL
Superior Court of the State of California. County of San Diego

EXHIBIT A

Exhibit A

TO THE AFFIDAVIT OF ADMIRAL HORNE

Roger B. Horne, Jr.
Rear Admiral, USN (Ret.)

Professional Competence
Design engineering, construction and operation of ships and ship systems. Shipyard operations including contract administration and major ship construction, overhaul and inspection. Industrial processes and inspection techniques related to shipyard and other major industrial work. Nuclear power plant design, construction, refueling, maintenance, and quality control. Development and interpretation of industrial specifications contract administration and financial management of large industrial projects.

Background and Professional Honors
B.S. (Naval Engineering), U.S. Naval Academy
M.S. (Mechanical Engineering), U.S. Naval Postgraduate School
M.B.A. (Executive), Golden Gate University
Shipyard Nuclear Shift Test Engineering School
Ship Construction School, Portsmouth Naval Shipyard
Dynamic Shock Analysis Course, Princeton
Navy Destroyer Engineering Course, Damage Control Course, and Fire Fighting Course
Qualified Naval Surface Ships and Submarines (Engineering Duty)
Recipient, Institute of Industrial Engineering Outstanding Achievement in Industrial Management Award
Recipient, Jack Flannigan award for Contributions to the Quality of Marine Machinery given by the Marine Machinery Association
Three Navy Legion of Merit awards and three Meritorious Service Awards for Engineering and Industrial Achievements
Patent for Timber Sterilization

Professional Profile
Principal Engineer and Head of the Marine and Aviation Practice Area.
Exponent, Failure Analysis Associates, Inc.
Visiting Professor,
Ship Construction, University of Michigan
Chief Engineer and Deputy Commander
Naval Sea Systems Command for Ship Design and Engineering
Deputy Commander
Naval Sea Systems Command for Facilities and Industrial Management
Commander,
Puget Sound Naval Shipyard
Commander,
Engineering Duty Officer's School
Production and Repair Officer,
Mare Island Naval Shipyard
Nuclear Engineering Manager,
Puget Sound Naval Shipyard
Nuclear Submarine Inspection Officer, Supervisor of Shipbuilding Office,
Ingalls Shipbuilding
Chief Engineer
USS OZBOURN DD 846
Past Member of the American Bureau of Shipping Technical Committee
Member, Society of Naval Engineers

Past Member Society of Naval Architects and Marine Engineers
Past member Society of Industrial Engineers
Past member American Bureau of Shipping

Exhibit B

TO THE AFFIDAVIT OF ADMIRAL HORNE

PRELIMINARY DRAFT
DO NOT USE FOR PURCHASE

35B2(SHIPS)
15 February 1949

BUREAU OF SHIPS SPECIFICATION

BOOKS, INSTRUCTION

PREPARATION, CONTENTS, AND APPROVAL

1. CLASSIFICATION

1.1 Types.- Instruction books shall be furnished in the following types as specified (see 6.1):

Type A (see 3.3).
Type B (see 3.4).
Type C (see 3.5).
Type D (see 3.6).

2. APPLICABLE SPECIFICATIONS AND OTHER PUBLICATIONS

2.1 Specifications.- The following specifications, of the issue in effect on date of invitation for bids, form a part of this specification:

Joint Army-Navy Specifications
JAN-P-105 - Boxes; Wood, Cleated, Plywood.
JAN-P-106 - Boxes; Wood, Nailed.
JAN-B-107 - Boxes; Wood, Wire-Bound.
JAN-P-125 - Barrier-Materials, Waterproof, Flexible.
JAN-P-140 - Adhesives, Water-Resistant, Case-Liner.

Navy Department Specification
General Specifications for Inspection of Material.

(Copies of Joint Army-Navy specifications and Navy Department specifications may be obtained upon application to the Bureau of Supplies and Accounts, Navy Department, Washington 25, D. C., except that activities of the Armed Forces should make application to the Supply Officer in Command, Naval Supply Center, Norfolk 11, Va. Both the title and identifying number or symbol should be stipulated when requesting copies.)

2.2 Other publications.- The following publications, of the issue in effect on date of invitation for bids, form a part of this specification:

Navy Administrative Office Publication
NAVEXOS P-29 - Security Measures for the Protection of Classified Printed Matter During Production.

(Copies of publication NAVEXOS P-29 may be obtained upon application to the Administrative Office, Navy Department, Washington 25, D. C.)

Bureau of Supplies and Accounts Publication
Navy Shipment Marking Handbook.

(Copies of the Navy Shipment Marking Handbook may be obtained upon application to the Bureau of Supplies and Accounts, Navy Department, Washington 25, D. C., except that activities of the Armed Forces should make application to the Supply Officer in Command, Naval Supply Center, Norfolk 11, Va.)

3. REQUIREMENTS

3.1 Material.- The minimum material requirements are as specified hereinafter. The best material commercially available for the purpose shall be used when a definite material is not specified. When the material specified is not available, substitutes may be used provided they are satisfactory to the bureau concerned.

3.2 Types A, B and C.-

3.2.1 Instructions books covering specific equipments.- Instruction books covering specific equipments shall be logically arranged, and contain the following information, preferably in one of the following arrangements (see figs. 1 to 10, inclusive except fig. 9):

3.2.1.1 First arrangement.-

(a) Title page (see fig. 2).
(b) Table of Contents, listing all chapters and primary and secondary subheadings with their corresponding page numbers.
(c) Serial Numbers of Equipments and, if required by the equipment contract or order, the Material Pattern Description (see 3.2.1.1.2).
(d) List of Illustrations and Plans, specifying titles, figure numbers and pages on which such illustrations appear.
(e) Chapter 1, Introduction.
(f) Chapter 2, Detailed Description.
(g) Chapter 3, Principles of Operations.
(h) Chapter 4, Operating Instructions.
(i) Chapter 5, Maintenance.
(j) Complete Parts List.
(k) Repair Parts and Special Tools List.
(l) Plans.
(m) Appendix.

3.2.1.1.1 Chapter 1, Introduction.- This chapter shall include a general description of the equipment, i.e., tell briefly what it is, where it is used, and what it will do, also all information of a general character applicable to the complete equipment. The description shall include a complete list of the equipment with pertinent ratings.

3.2.1.1.2 Chapter 2, Detailed Description.- This chapter shall contain a complete description in pattern detail of the component assemblies and accessories which constitute the complete equipment. These shall be in conformance with the Material Description Patterns to be provided by the bureau concerned, and shall be included on a separate page immediately following the Table of Contents. Integrated with the physical description shall be a description of the mechanical and electrical operation of the component assemblies and accessories. Allowable clearances, temperatures, tolerances, weights, etc., shall be shown in tabular form.

3.2.1.1.3 Chapter 3, Principles of Operations.- This chapter shall contain a brief resume of the principles of operation, together with such illustrations, sketches and internal wiring diagrams as are considered necessary to the prompt comprehension of equipment of new design or application. (For example, if the instruction book covers or includes rotary amplifier - or other equipment of relatively new design - complete information covering their principles of operation should be given in this chapter.)

3.2.1.1.4 Chapter 4, Operating Instructions.- This chapter shall cover complete instructions for the operation of the equipment, including precautions and tests which should be made before initial starting after installation or after a major overhaul. These precautions and tests shall be clearly designated and shall preferably be the first information presented in this chapter. Where operations are to be performed in specified sequence, step-by-step procedure shall be used. Operations shall be numbered in the order in which they are to be performed. Operating data which is frequently referred to in operating the equipment shall be included in this chapter.

3.2.1.1.5 Chapter 5, Maintenance.- This chapter shall include all the necessary instructions for the proper care and maintenance of the equipment, i.e., logically arranged and complete instructions for inspecting, cleaning, lubricating, adjusting, disassembling, assembling, and repairing the equipment, and when, to perform each of these operations. Such expressions as "replace bent or worn parts when discovered" shall be avoided, if possible, and specific parts which may be come bent or worn shall be mentioned. The instruction on lubrication shall include information regarding lubrication recommended by the manufacturer, the type of lubricant to be used, together with specific time periods. This may be shown in tabular form. The number and types of lubricants required shall be held to a minimum. Lubricants shall be described by Navy specification numbers where applicable, and by commercial designations.

3.2.1.1.6 Complete Parts List.- A complete parts list, listing all procurable renewal parts by manufacturer's part numbers, shall be inserted in the instruction book immediately following Chapter 5. If, however, the complete parts list and/or the instruction book is of such thickness that the addition of the parts list would make the final book contain over 400 pages, then the parts list shall be contained in a separate volume with appropriate reference on each volume as to the content of the other volume. (See 3.2.1.1.10.)

3.2.1.1.7 Repair Parts and Special Tools List.- All instruction books covering equipments shall contain a listing of all parts and/or assemblies that are wearable and/or expendable during normal repair; also, a listing of special tools furnished under the equipment contract or order. The parts and special tools listed shall be identified by manufacturer's part numbers, drawings and piece numbers.

3.2.1.1.8 Plans.- Immediately following Chapter 5 (or the Repair Parts and Special Tools List) such plans as are required shall be included in the instruction book. In cases where reduced size reproductions of standard approved plans are used as illustrations in connection with the text, these plans may be inserted throughout the text near the places where referenced.

3.2.1.1.9 Appendix.- The appendix shall include such information as test data, contract guarantees, the number of the drawings containing the basic-plan list, and similar information.

3.2.1.1.10 Arrangement of parts lists.- Arrangement in list shall consist of the following:

(a) Title page. (Only if parts list is published as a separate book.)
(b) Table of contents. (Only if parts list is published as a separate book.)
(c) List of illustrations by figure and page number.
(d) Section 1, Introduction.
(e) Section 2, Complete Parts List.
(f) Section 3, Repair Parts and Special Tools.
(g) Section 4, Standard Hardware.
(h) Section 5, Numerical Index of part numbers.

3.2.1.1.10.1 Section 1, Introduction.- This section shall contain sufficient instructions to explain the following:

Any symbols used therein.
The general system of group assemblies in relation to the complete article.
All cross-index systems employed.
Titles or other markings intended to segregate different models.
Other information as may be required to facilitate rapid and accurate use of the Complete Parts List and Repair Parts and Special Tools List.

3.2.1.1.10.2 Section 2, Complete Parts Lists.- Complete parts lists when furnished either as part of an instruction book or as a separate book shall contain the following information:

Figure number. This shall denote the illustration number wherein the part has been shown.
Index number. This shall denote the index number covering the complete main or sub-assembly as listed in the catalog.
Manufacturer's drawing number.
Manufacturer's part number.
Pieces required.
Unit of issue (i.e., each, pair, set, foot, etc.).
Description of components and of parts: Descriptions of components covered will be in accordance with set patterns furnished by the bureau concerned upon request. Nomenclature of parts will consist of the generic article name followed by modifying description to indicate all characteristics differentiating one part from another, in a noun, adjective, location or description sequence.

In the case of purchased parts, the name and part number, if any, of the prime manufacturer shall be given, as well as the part number of the component manufacturer.

A group-assembly parts list shall divide the major assembly into the main and minor assemblies as they are built for final assembly. The breakdown shall list every component part in its proper sequence of assembly with the exception of those parts not procurable separately as maintenance parts. The subassembly details shall be arranged and properly indented to indicate the relationship to the subassembly. In the parts list, service assemblies and subassemblies which are minimum repair or replacement items shall be assigned part numbers and the parts thereof shall be marked clearly "Not Serviced Separately".

3.2.1.1.10.3 Section 3, Repair Parts and Special Tools List.- When the list of repair parts and special tools is incorporated in the same book with complete parts list, the repair parts list shall be arranged to show the quantity, description, index number, manufacturer's part number and unit of issue (i.e., each, pair, set, foot, etc.).

3.2.1.1.10.4 Section 4, Standard Hardware.- Standard commercial hardware as shown on the illustrations may be listed separately and shall include all items procured from another (prime) manufacturer, the prime manufacturer's identification (part numbers), and Navy identification numbers (to be obtained from Ships Parts Control Center, Naval Supply Depot, Mechanicsburg, Pa.).

3.2.1.1.10.5 Section 5, Numerical Index of Part Numbers.- All items listed in the parts section shall be arranged in a logical numerical sequence. These shall be so arranged that column 1 will give the manufacturer's part number and column 2 will give the illustration index number or numbers in which the part appears.

3.2.1.1.10.6 Illustrations.- A view of each assembly and subassembly and their component parts shall be shown. Identification of illustrated parts with the listed parts shall be facilitated by the use of key or index numbers which will identify all the parts in the group assembly listing.

3.2.1.1.10.6.1 Illustrations of the exploded type are preferable. When the use of exploded views is not practical, simple cross-sectional views may be used. The cross-sectional drawings used for this purpose shall be approved plans or excerpts from approved plans, and shall show both the manufacturer's drawing number and the plan number of the bureau concerned. In case no applicable approved plan is available, cross-sectional views from manufacturer's drawings may be used.

3.2.1.1.10.6.2 A figure number and proper identifying caption shall appear with each illustration. In the case of subassemblies or sub-subassemblies, the caption shall also identify and give the index number of the complete assembly as it appears in the parts listing.

3.2.1.1.10.6.3 An index number with an arrow to the item, part, or tool to which it pertains shall be used in illustrations. In cases where an assembly is exploded into its component parts, one or more of which require further explosion, the primary explosion shall be referenced by the use of numerals only. The sub-assembly shall be referenced by the basic number of the part as it appears in the primary assembly but each exploded part shall have an alphabetical designation, suffixed to the number of the primary parts. The sequence of numerical and alphabetical designations shall correspond to the order of removal upon disassembly, wherever practicable.

3.2.1.1.10.7 Color.- Under no circumstance shall color be used in repair parts or complete parts lists.

3.2.1.1.10.8 Nomenclature.- Index numbers and arrows shall be used on each illustration to identify procurable renewal parts only.

3.2.1.2 Second arrangement.-

(a) Title page (see fig. 2).
(b) Introduction, giving a brief general outline of the purpose of the manual with a brief discussion of its contents.
(c) Table of contents, which shall be a general index by sections with corresponding page numbers.
(d) Section 1, Description and Arrangement of Unit.
(e) Section 2, Specifications. This section shall give general data, pump capacities, engine rating, recommended operating data, clearance tolerances, etc.
(f) Section 3, Installation. This section shall give methods of installation, alignment, adjustments, precautions, etc.
(g) Section 4, Operation. This section shall describe starting procedure, stopping procedure, idling, and normal operating routine.
(h) Section 5, Inspection, Maintenance, and Adjustments. This section shall include general inspection and maintenance shhedules - no detailed procedures involving overhaul - but a general schedule as to when various operations should be performed.
(i) Section 6, Cylinder Block.
(j) Section 7, Cylinder Liners.
(k) Section 8, Pistons.
(l) Section 9, Cylinder Head.

NOTE: Sections 6 through 9 (as an example) represent parts of a Diesel engine. The arrangement and total number of sections shall be such as represent the break-down of the entire equipment into logical groups or areas. Each of these sections shall be further subdivided into description and function, adjustments, specifications (where applicable), and overhaul procedures. The order of presentation of these sections may be varied as required to best suit the particular equipment involved.

(m) Section 10 - Complete Parts List. The requirements of 3.2.1.1.6 and 3.2.1.1.10 shall apply.
(n) Section 11 - Repair Parts and Special Tools List. The requirements of 3.2.1.1.7 shall apply.
(o) Section 12 - Plans. The requirements of 3.2.1.1.8 shall apply.
(p) Section 13 - Index. This section shall contain a detailed alphabetical index when considered necessary in order to allow quick and ready reference to portions of the book.

3.2.2 Instruction books covering systems.- Instruction books covering systems such as engineering piping systems shall follow the arrangements shown in 3.2.1 as closely as possible so far as they are applicable to books of this type. When an instruction book covers a system or an equipment composed of several distinct units (for example, a generating set consisting of a Diesel engine, a generator, a voltage regulator, and a controller), it may be desirable to arrange the book in chapters (or sections), each chapter (or section) covering one unit. If so, the chapters may be arranged by sections, each section corresponding in order and content to the chapters specified in 3.2.1.

3.2.3 Chapters and sections.- Chapters shall be numbered or lettered consecutively. The first page of each chapter shall be arranged as shown on figure 3. Where practicable, large books shall be broken down by chapters, and each chapter should be further broken down by sections, which shall be numbered or lettered consecutively within the chapter. Small books shall be broken down by sections, and the sections numbered or lettered consecutively throughout the book.

3.2.4 Page identification and numbering.-

3.2.4.1 At the top of each left-hand page, flush with the outside margin, shall appear a briefed title of the publication followed by the manufacturer's identification number, if used. At the top of each right-hand page, flush with the outside margin, shall appear the chapter or section number followed by its title. In some cases, it may be necessary to brief the title. These running heads are shown on figure 4.

3.2.4.2 With the exception of fold-over pages and as otherwise specified, pages of the instruction books shall be numbered consecutively in the bottom outside corner of each page, using Arabic numerals. The first page of chapter 1 or section 1 shall be page 1. All odd-numbered pages shall appear as right-hand pages. Fold-over pages shall be right-hand pages, and when they are used within the text they shall be assigned two page numbers, and the numbers shall be printed on the face of the sheet. Fold-over page arrangements are shown on figure 5.

3.2.4.3 In books arranged for a system or equipment composed of several distinct units (see 3.2.2) the pages may be consecutively numbered within each chapter (or section), the first page of each chapter (or section) being page 1. In this case, the page number shall also include the chapter number. The chapter number shall appear first.

3.2.5 Revision to incorporate changes.- The contractor shall be required to furnish new and/or revised pages covering all changes until the guarantee period expires. New pages shall be identified with the following legend placed beside the page number and toward the binding edge of the page; on the the first line, the word "New" followed by the publication identification number, and on the second line the month and year of issue. A similar procedure shall be followed for revised pages except the word "Revised" shall be substituted for the word "New".

3.2.6 Layout treatment.- The layout of instruction books shall be such as to conserve space without detracting from the usability or clarity of material presented. Blank pages and spaces shall be avoided wherever possible. Textual material shall be printed on both sides of the page. Illustrations serving no instructional function or to which no reference is made in the text shall not be used. Partial page illustrations within the text are desirable. Several small illustrations may be grouped to form a single page layout. Wherever possible, illustrations shall be located so that reference can be made from applicable text without turning a page. Fold-over pages, double, or triple pages will be permitted only for illustrations where this procedure is essential to insure legibility. Fold-over pages shall be used primarily in the back of the book for the purpose of reproducing the plans. Whenever it is desirable to include fold-over pages with the text in the front part of the book, such fold-over pages shall not be backed up with text or illustrations.

3.2.7 Text.-

3.2.7.1 Presentation.- The principles and rules of grammar and punctuation shall be strictly observed. All related data shall be grouped in a logical manner. If the work requires a series of operations, each operation shall be treated in logical sequence.

3.2.7.2 Tables and charts.- The use of tables and charts is desirable. Such tables and charts shall not be elaborate or complicated, and sufficient explanation shall be given to make them easily understood.

3.2.7.3 References to figures.- Where reference is made to figures, the reference shall be to the figure number. The page number shall not be used except when the illustration is located more than three pages away from the reference. When reference is made to items shown on figures by index numbers, figure number and index number shall be indicated as follows: "Remove nut (7) and drive out bolt (8). (See fig. 26.)"

3.2.7.4 Numbers.- Numbers from one to nine, inclusive, appearing in the text for the purpose of stating quantities shall be spelled out. All other numbers shall be shown as numerals except when they are used at the beginning of a sentence, in which case they shall be spelled out and followed by the numeral in parenthesis.

3.2.7.5 References to materials.- All materials required for maintenance referred to in the instruction book, such as lubricants, sealing materials, abrasives, etc., shall be described by specification numbers where applicable.

3.2.8 Illustrations.- Illustrations shall be well planned and executed. They shall enable immediate and thorough comprehension of the subject. Illustrations shall not be signed by an artist.

3.2.8.1 Illustration identification.- Illustrations shall be identified by section (or chapter) number and figure number and a title. Identifying figure numbers and titles shall be positioned immediately beneath the illustration. Whenever reduced size reproductions of plans are used as illustrations, the plan number shall be shown as well as the figure number.

3.2.8.2 Photographs.- Photographic illustrations shall be prepared with equipment capable of reproducing all details and shall show clearly the subject matter. Good lighting, proper exposure, and sharp contrast between details of the view are required. Photographs shall be uniformly retouched to define shapes, accentuate details, and establish correct tone value of sufficient contrast for photolithographic reproduction.

3.2.8.3 Exploded views.- Exploded views are desirable for showing the component parts of a subject. Well retouched photographs in which sharp contrast is incorporated to insure distinct detailed separation of parts may also be used for this purpose. All parts shall be exploded on their functional axis.

3.2.8.4 Plans.- When plans are necessary to illustrate the description, operation, and maintenance of the equipment or system, they shall be reduced in size as shown on figure 5, and reproduced in black and white. Each plan shall be identified with the plan number of the manufacturer and the bureau concerned. Plans shall be bound into the instruction book as shown on figure 5. Plans shall normally be placed in the back of the manual but they may be inserted close to the references when practicable.

3.2.8.5 Drawings.- (See fig. 6.)

NOTE: This paragraph does not pertain to reduced-size reproductions of standard approved plans nor to portions of these plans which may be extracted and used as illustrations in a book.

3.2.8.5.1 The rendering of drawings (airbrushing or line rendering) shall be done with the highest possible contrast. Adjoining areas of an illustration having similar values are to be avoided. Edges of all silhouette half-tone illustrations should be sharply defined by retouching.

3.2.8.5.2 Exploded views and cutaway views should be drawn in perspective to appear as realistic as possible without distortion. Isometric views may be used for small parts or units which lend themselves to this method without showing noticeable distortion.

3.2.8.5.3 Except for diagrams, schematics, orthographic projections, reproductions of approved plans, etc., all line drawings shall be prepared with the use of shading mediums to clarify and model the form of the drawing. This rendering shall be kept as simple as possible. Fuzzy freehand line, rendering with fine lines, cross hatching, etc., shall be avoided. Solid black shall be used in dark areas to increase contrast and simplify the drawing. This applies to cutaway views, exploded views and cross-section views.

3.2.8.6 Indexing and referencing of illustrations.-

3.2.8.6.1 Significant features or components of illustrations shall be identified by brief applicable nomenclature with arrows. Index numbers may be used on illustrations with explanatory legend under the drawing or photo only when an extremely large amount of nomenclature is required.

3.2.8.6.2 In order to assure a clear definition of lines where they pass through light and dark areas, arrows (leaders) shall be drawn in black with one edge outlined in white. The arrowhead, however, shall be completely outlined in white. The thickness of arrows shall be uniform and no greater than necessary to indicate clearly the desired details.

3.2.8.6.3 Index references and letterings (nomenclature) shall be prepared with the aid of a mechanical device or with type-set characters affixed. They shall be planned to reproduce uniformly in a size not less than 10-point type. Where index numbers are used, each illustration shall be handled independently with index numbers assigned consecutively, starting with number 1.

3.2.9 Color.- Color shall be used functionally where necessary to show electric circuits, the flow of materials, schematic diagrams, operational diagrams, etc. Unessential color shall not be used. Backgrounds of color tints may be used to clarify outline drawings, but color for decoration will not be accepted.

3.2.10 Nomenclature.- Nomenclature shall be uniform throughout the instruction book.

3.2.11 Copyright.- Instruction books shall not be copyrighted. (The Navy reserves the right to reproduce or have reproduced in part or in their entirety all instruction books procured under this specification.)

3.2.12 Security classification.- Unless otherwise specified, instruction books shall be unclassified. If restricted, confidential or secret, notification of this classification shall appear on the front and back covers and each page of the book as shown on figures 1 to 10, inclusive. Confidential and secret instruction books shall be marked with consecutive serial numbers beginning with number 1. Classified instruction books shall be prepared in accordance with the requirements of the Navy Handbook Security Measures for the Protection of Classified Printed Matter During Production (NAVEXOS P-29). Particular care shall be exercised to insure the security of the classified matter during the preparation. Receipt cards shall be provided in all confidential and secret books. Each card shall contain the serial number of the book in which it is included.

3.2.13 Approval.- Prior to printing of instruction books, the complete text shall be submitted to the bureau concerned, via the Naval Inspector, for approval. Manuscripts shall be submitted in duplicate. All copy which will finally appear on the cover, backbone, and printed page shall be included. The text shall include figure references to the illustrations.

3.2.14 Identification.- All books shall be identified by a Navy identification number of the form "NAVSHIPS 362-1023" (see figs. 1 and 2). This number will be assigned by the bureau concerned upon receipt of the copy submitted for bureau approval. In cases of emergency, this number may be obtained by a written request, containing complete descriptive data of the equipment. This number shall be imprinted on the upper left-hand corner of the cover and upper right-hand corner of the fly-leaf of all books prior to distribution.

3.2.15 Form.- Unless otherwise specified, the instruction books shall be supplied as complete, printed, and bound publications.

3.2.16 Printing.- Printing shall be done by either offset, lithograph or letterpress method, and shall be of equal quality to first-class commercial work. Copy may be type-set, varityped, or typewritten with a standard typewriter. In general, type-set copy is preferred with varityped copy as second choice. The style of composition to be used, however, shall be governed by the quantity of books to be produced, the relative costs of the several methods, the availability of material prepared for earlier books, etc. The contractor shall specify the method of composition to be used when manuscripts or sample copies are submitted for approval. The bureau concerned may request data from the contractor to substantiate the method of composition chosen if deemed desirable.

3.2.16.1 Text arrangement.- When the text is type-set or varityped, it shall be divided into two vertical columns (see figs. 4 and 7). Occasional deviation from this procedure is permissible where good judgment indicates a single wider column or other style of format. All right-hand margins on type-set or varityped books shall have lines flush at the right. When text is typewritten, text shall normally be prepared in single wide column, occupying approximately the same space as the two columns (see fig. 8). Right-hand margins shall not necessarily have lines flush at right, but care shall be taken to prepare a generally uniform margin. The size of the page shall be 8-1/2 by 11 inches, as shown on figure 1. Text shall be reproduced on both sides of pages.

3.2.16.2 Negatives, vandykes and press-proof copy.-

3.2.16.2.1 Negatives.- Negatives shall be furnished for all pages reproduced by the photo-offset process in conformance with the following:

3.2.16.2.1.1 General.- Negatives shall have been subject to correct exposure, proper development, and sufficient fixing and washing. Negatives shall have such a quality that metal plates can be printed therefrom using a normal exposure without dodging.

3.2.16.2.1.2 Material.- The sensitive coating shall be on a safety base, not more inflammable than newsprint paper. The film shall lie flat and have a good printing surface.

3.2.16.2.1.3 Placement of film.- When used in the camera, the film shall be supported in either a suction-back film holder, an adhesive-back holder, a film or plate holder, or between glass. If the latter support is used, it shall be free from dust particles or other foreign matter which might cause pinholes or scratches in the negative.

3.2.16.2.1.4 Half-tone negatives.- Half-tone negatives shall possess sufficient dot opacity and size in the shadows to withstand any tendency to "fill in" on the press plate and become a solid. The size of the opaque shadow dot on the negative, however, shall not be so large, as the result of the flash exposure, as to flatten the resulting print and produce a loss of detail. The negative shall be comprised of more than a simple screen grading with an average amount of detail. They shall possess the following characteristics:

(a) Opaque dots of correct size to represent the correct tones on the offset paper after passing through the press.
(b) Sufficient opacity to allow for proper press-plate preparations.
(c) Detail throughout tonal graduations, especially in the shadows.
(d) A shadow dot which will not allow filling in on the press plate.
(e) Highlights which will reproduce as halftone highlights on the offset paper, in proper balance with other tones of the reproduced image.
(f) Screening which shall be not less than 110 lines per inch and not more than 133 lines per inch.

3.2.16.2.1.5 Line negatives.- Line negatives shall be free from spots, scratches, pinholes and the like in the opaque coating so that subsequent printing on grained metal will not require any handiwork. Any ragged edges, filled-up shadows, and broken lines shall be repaired.

3.2.16.2.2 Vandykes.- A complete set of vandykes, plus required photographic negatives, shall be supplied for all final books prepared by the blueprint, ozalid, or other transparency method.

3.2.16.2.3 Press-proof copy.- The following shall be furnished for pages reproduced by the letterpress method:

(a) A glossy 8- by 10-inch original print of each photograph (and overlay).
(b) A clean, sharp press-proof copy of each page (preferably on coated stock) printed on one side only, and trimmed to approximately 8-1/2 by 11 inches.

3.2.16.3 Paper.- The paper for photolithographic reproduction shall be preferably 25 by 38-60/500-basis white wove; for letterpress 25 by 38-70/500 basis dull-finish enamel stock. All coated paper shall be of the waterproof variety.

3.2.17 Covers.- Covers for types A, B and C books less than 1/2 inch thick (less cover) shall be of the bellows fold type and of a fabrikoid material. Covers for books over 1/2 inch in thickness shall be made of semiflexible board covered with a fabrikoid material.

3.2.17.1 Printing.- The covers shall be imprinted in gold leaf with the information shown on figure 1. Silver, aluminum, or white lettering may be used when satisfactory to the bureau concerned.

NOTE: The backbones of these books shall be imprinted with the NAVSHIPS number (see 3.2.14), title in brief, and manufacturer's identifying number (if used).

3.2.17.2 Binding.- The binding shall be looseleaf using three 3/16-inch metal posts and screws, or other metallic fastener satisfactory to the bureau concerned, spaced on 4-1/4-inch centers. Covers for books 1/2 inch thick or more shall have a binding flange of corrosion-resisting metal covered with 700 quality fabrikoid. On books containing less than 50 pages (25 sheets), split-type metallic fasteners with metallic washers may be used. All metal parts shall be of corrosion-resisting material, or shall be treated to resist corrosion.

3.2.17.3 Overlap.- Covers shall slightly overlap the top, bottom, and right-hand edges of the pages of the book by approximately 3/16 inch. Outside corners of covers shall be slightly rounded.

3.3 Type A instruction books.-

3.3.1 Contents, general.- In books covering equipment, photographs of the completely assembled equipment as well as of each subassembly shall be included. Wherever photographs fail to provide an immediate and thorough comprehension of the subject, cross-sectional, exploded, isometric, or perspective drawings shall be used. In books covering systems, schematic line drawings may be substituted for photographs of equipment and subassemblies. Wherever step-by-step procedure is complicated or where the procedure is not immediately apparent from the description, each step shall be adequately illustrated. Color shall be used where necessary to improve the clarity or effectiveness of illustrations and line diagrams.

NOTE: Type A books differ from type B books in that they contain a more elaborate description of the the system or assembly, including many photographs in color. Type A books also differ from type B in the method of approval (see 3.3.2 and 3.4.2). Type A books should be specified only in specific instances on new design of equipment where it is considered desirable to review and approve a preliminary outline of the book prior to the preparation of any art work or manuscript.

3.3.2 Method of approval.- (See 3.2.13 for procedure to be followed.)

(1) Prepare a comprehensive outline including chapter, headings, primary subheadings and secondary subheadings, and a tentative list of illustrations, their subject and type.
(2) Submit a representative chapter.
(3) Submit a full-size dummy for the book after approval of (2) above. This dummy shall include sketches of the illustrations in the size they will appear in the final printed publication. The illustrations shall be shown in sufficient detail to determine the subject and its illustrative treatment, and the manuscript and art work shall be keyed to position in the dummy. Page headings, titles and all subheadings shall be shown. Typical examples of the art work shall be included.
(4) Submit manuscript in duplicate bound in a folder with a suitable loose-leaf fastening device.
(5) After approval of manuscript submit a final page proof. This may be a complete blueprint proof or type-page proof with paste-in blue prints or black and white prints of the illustrations.

3.4 Type B instruction books.-

3.4.1 Contents, general.- In books covering equipment, photographs of the completely assembled equipment as well as of major subassemblies shall be included. In books covering systems, schematic line drawings, or similar illustrations, may be substituted for photographs of equipment. Cross-sectional, isometric, exploded, or perspective views of the complete equipment and/or its major assemblies shall be used wherever applicable and wherever such views are absolutely essential to prompt comprehension of the subject. Wherever step-by-step procedures are complicated or where the procedure is not immediately apparent from the description, such steps shall be adequately illustrated. Color shall be used principally in complicated diagrams and illustrations where it is essential to prompt comprehension of the way in which the subject operates.

3.4.2 Method of approval (see 3.2.13).-

(1) Prepare a comprehensive outline of the instruction book, including chapter headings, primary subheadings, and secondary subheadings, and including a tentative list of the illustrations, their subject and type.
(2) Submit the complete text and a comprehensive layout for a representative chapter. In lieu of the comprehensive outline including references to the illustrations, the contractor may submit a previously prepared final instruction book covering the same kind of equipment.
(3) Subsequent to this bureau approval, a complete text, a list of the illustrations identified with the text, also blueprints, photos or sketches of all illustrations using color as well as of cross-sectional, perspective, or isometric drawings, shall be prepared and submitted to the bureau concerned.

3.5 Type C instruction books.-

3.5.1 Contents, general.- Where the instruction book covers a specific equipment at least one photograph of the completely assembled equipment shall be included. Where the instruction book covers systems and similar things that cannot conveniently be photographed, a schematic line drawing shall be included.

3.5.2 Method of approval (see 3.2.13).- If similar instruction books have been approved on other contracts, the contractor may submit a sample copy of the proposed book for approval in lieu of the typewritten manuscript.

3.6 Type D instruction books.-

3.6.1 Contents.- Instruction books shall consist of manufacturer's standard inserts bound together as specified hereinafter. The book shall contain a description of the equipment, operating, lubricating and maintenance instructions; a small-scale outline giving over-all and mounting dimensions, cross-section and assembly views in sufficient detail to indicate the parts and their numbers; bill of material or parts list, with reference to the part numbers; list of repair parts, list of tools, wiring diagram, winding data for any motors and control equipment, classification of any motor and control equipment, and any other information considered necessary for the proper maintenance and repair of the equipment. Books shall be approximately 8-1/2 by 11 inches, and where drawings are included in the binding they shall not be folded perpendicular to the binding and not more than twice parallel to the binding.

3.6.2 Covers.- The covers shall be of the bellows fold type, and shall be made of a good grade of pressed fiber having a smooth finish. The covers shall be light gray, tan, light blue, or other color that will lend contrast to the lettering in black or blue. The covers shall be lettered with a mechanical lettering device and black waterproof ink, in the approximate size letters and form indicated on figure 9. Imprinting with type in equivalent size letters as shown in figure 9, in lieu of using a mechanical lettering device, will be satisfactory.

3.6.3 Method of approval.- The procedure described in 3.2.13 shall be followed for approval of type D books.

3.6.4 Identification.- Identification numbers shall be assigned as specified in 3.2.14 (see fig. 9).

3.7 Time of delivery.- Unless otherwise specified, instruction books shall be delivered with the first unit of equipment shipped. If final instruction books are not available at the time of delivery of the equipment, two copies of an adequate preliminary instruction book (see 3.9) shall be supplied to the Naval inspector for shipment with each unit. In all cases where preliminary books are supplied, they shall be replaced with final books within 60 days.

3.8 Quantity to be furnished.- Unless otherwise specified, the instruction books shall be furnished as follows:

One copy to the Naval inspector.
Two copies to the bureau concerned.
Two copies shall be packed with each equipment, unless otherwise specified.

3.8.1 Bulk copies for stock shall be furnished as follows:

Number of equipments	Number of copies
1 to 5	25
6 to 25	25 plus 2 per equipment
26 to 950	50 plus 1 per equipment
Over 950	1000

3.8.2 Books furnished in accordance with 3.8.1 shall be shipped to:

Supply Officer in Command,
Ship Parts Control Center
Naval Supply Depot
Stock Control Department
Mechanicsburg, Pa.

3.9 Preliminary instruction books.-

3.9.1 General.- If it appears impossible to produce final instruction books by the time the first production equipment is ready for delivery, the contractor shall request authority of the bureau concerned to supply preliminary instruction books.

3.9.2 Method of approval.- The procedure described in 3.2.13 shall be followed for approval of preliminary instruction books.

3.9.3 Printing.- The text may be printed by any quick, economical method, such multigraph, mimeograph or similar method.

3.9.4 Contents.-

3.9.4.1 Text.- Unless otherwise specified, preliminary instruction books shall include the complete text as it is submitted to the bureau concerned for approval of final instruction books.

3.9.4.2 Illustrations.- Preliminary instruction books shall contain a complete list of the illustrations which will appear in the final book. If the final book is to include test data, or a table of weights, for example, and if any or all of the items are not available when the preliminary book is issued, then a foreword shall list all items which have been omitted and which will appear in the final book.

3.9.5 Book identification.- Book identification number shall be stamped on all copies of preliminary instruction books prior to distribution (see 3.2.14).

3.9.6 Covers.- Covers for preliminary books shall be at least 20 by 26-65/500-basis gray antique finish cover stock or similar material, bellows fold, with the title and other pertinent information on the cover. This information shall be identical with that which will appear on the final book except that the word "preliminary" shall appear directly in front of the identification number (see 3.2.14).

3.10 Workmanship.- The workmanship shall be of high quality comparable in text compilation, arrangement, and accuracy to high-grade, commercial instruction books and parts catalogs. Copy which has filled letters or is blurred will not be accepted. The workmanship shall be satisfactory to the bureau concerned.

4. SAMPLING, INSPECTION AND TEST PROCEDURES

4.1 The methods of approval are given in section 3.

5. PREPARATION FOR DELIVERY

5.1 Packaging.-

5.1.1 For domestic shipment.- Commercial packaging will be acceptable.

5.1.2 For overseas shipment.- Instruction books shall be individually packaged and sealed in waterproof envelopes or wrapped and sealed in waterproof paper, the material of which shall conform to the requirements for types C-1, E-1 or better of Specification JAN-P-125. The seams and closures of envelopes and wrappers shall be sealed with adhesive conforming to the requirements of Specification JAN-P-140. Care shall be exercised in the use of papers having a lamination of asphaltum to prevent a deleterious effect on the books.

5.2 Packing.-

5.2.1 For domestic shipment.- The subject commodity, packaged as described in 5.1.1, shall be packed in cleated plywood boxes, nailed wood boxes, or wirebound boxes conforming to the requirements of Specifications JAN-P-105, JAN-P-106 and JAN-B-107, respectively, or in suitable style corrugated or solid fiberboard boxes conforming to the following requirements:

Maximum gross weight	Minimum average bursting strength	Maximum sum of inside dimensions
Pounds	Pounds	Inches
40	200	60
65	275	75

Bottom flaps of fiberboard boxes shall be sealed by means of a suitable adhesive or metal-stitched. Top flaps shall be sealed, stitched, or taped, or closed by a combination of these methods. If taped, kraft gummed tape of not less than 2-1/2-inch width, 60-pound minimum basis weight or equal shall be used. Each shipping container shall be lined with a sealed waterproof bag made of material conforming to the requirements of Specification JAN-P-125. The seams and closure shall be sealed with adhesive conforming to the requirements of Specification JAN-P-140. The gross weight of boxes of wood construction shall not exceed approximately 150 pounds.

5.2.2 For overseas shipment.- The subject commodity, packaged as described in 5.1.2, shall be packed in cleated plywood boxes or nailed wood boxes, conforming to the requirements of Specifications JAN-P-105 and JAN-P-106, respectively. The gross weight shall not exceed approximately 160 pounds.

5.3 Marking.- In addition to any special marking required by the contract or order, interior packages and shipping containers shall be marked in accordance with the requirements of the Navy Shipment Marking Handbook.

6. NOTES

6.1 Ordering data.- Invitations for bids and contracts or orders should specify the following:

Title, number and date of this specification.
Type of instruction book required (see 1.1).
Security classification, if required (see 3.2.12).
Any additional information to be included in the appendix (see 3.2.1.1.9).

6.2 For instruction books for electronic equipment under the cognizance of the Electronics Division of the Bureau of Ships, see Bureau of Ships Specification 16B16(RE).

6.3 If standard commercial instruction books are desired contracts or orders should so state, and no reference should be made to this specification. Where a commercial instruction book must be modified, it is suggested that one of the types of books specified herein be ordered instead.

Notice.- When Government drawings, specifications, or other data are used for any purpose other than in connection with a definitely related Government procurement operation the United States Government thereby incurs no responsibility nor any obligation whatsoever; and the fact that the Government may have formulated, furnished, or in any way supplied the said drawings, specifications, or other data, is not to be regarded by implication or otherwise as in any manner licensing the holder or any other person or corporation, or conveying any rights or permission to manufacture, use, or sell any patented invention that may in any way be related thereto.

FIGURE 1 - TYPICAL COVER - Types A, B and C Books.

BUREAU IDENTIFICATION AND NUMBER OF PUBLICATION appears in upper left-hand corner, set in 18pt. Stymie light caps with Stymie bold numerals.

SECURITY CLASSIFICATION (See 3.2.12) appears in upper right-hand corner, set in 18 pt. Stymie light caps. (Security Classification in this case is "Restricted".)

TYPE OF BOOK set in 24 pt. Stymie extra bold upper and lower case.

SPECIFIC TITLE OF BOOK set in 30 pt. Stymie extra bold caps.

MANUFACTURER'S NAME AND ADDRESS

MANUFACTURER'S CONTRACT NUMBER TO be set under Manufacturer's name as shown, in 18 pt. Stymie light, upper and lower case.

MANUFACTURER'S BOOK NUMBER OR IDENTIFICATION

NAME OF BUREAU, NAVY DEPARTMENT, WASHINGTON, D.C., to be set at bottom of page in 12 pt. Stymie light caps, letter spaced and separated as shown.

SECURITY CLASSIFICATION (See 3.2.12) appears in lower left-hand corner, set in 18 pt. Stymie light caps. (Security Classification in this case is "Restricted".)

NOTE - If Stymie is not available, the following faces may be substituted in this order: Beton, Girder, Futura and Kabel, Weights shown shall be maintained.

NAVSHIPS 000—0000 RESTRICTED

INSTRUCTION BOOK

450-KW A-C/D-C GENERATOR SET STEAM-TURBINE-DRIVEN

MANUFACTURER'S NAME, AND ADDRESS

Contract Nobs — 00000

MANUFACTURER'S BOOK NUMBER

BUREAU OF SHIPS — NAVY DEPARTMENT — WASHINGTON D.C.

RESTRICTED

B-11640

FIGURE 2 - TYPICAL TITLE PAGE FOR TYPE A, B, AND C BOOKS.

SECURITY CLASSIFICATION (See 3.2.12) appears in upper left-hand corner, set in 18 pt. Stymie light caps. (Security classification in this case is "Restricted".)

BUREAU IDENTIFICATION AND NUMBER OF PUBLICATION appears in upper right corner, set in 18 pt. Stymie light caps with Stymie bold numerals.

TYPE OF BOOK set in 24 pt. Stymie extra bold upper and lower case.

SPECIFIC TITLE OF BOOK set in 30 pt. Stymie extra bold caps.

APPLICABLE VESSELS (when appropriate) to be set under title of book, as shown, in 18 pt. Stymie light, upper and lower case.

MANUFACTURER'S NAME AND ADDRESS

MANUFACTURER'S CONTRACT NUMBER to be set under Manufacturer's Name and address as shown in 18 pt. Stymie light, upper and lower case.

MANUFACTURER'S BOOK NUMBER OR IDENTIFICATION

DATE OF PUBLICATION to be included at the lower right of page, taking the place of "Washington, D.C."

SECURITY CLASSIFICATION (See 3.2.12) appears in lower right-hand corner, set in 18 pt. Stymie light caps with Stymie bold numerals.

RESTRICTED

NAVSHIPS 000-0000

INSTRUCTION BOOK

450-KW A-C/D-C GENERATOR SET STEAM-TURBINE-DRIVEN

CL-55 CLASS

MANUFACTURER'S NAME AND ADDRESS

Contract NOBS-00000

MANUFACTURER'S BOOK NUMBER

BUREAU OF SHIPS-NAVY DEPARTMENT — JANUARY 1949

RESTRICTED

8-11640

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FIGURE 3 - TYPICAL CONTENTS PAGE

CHAPTER TITLE to appear in upper right-hand corner, set in 18 pt. Futura bold caps.

CHAPTER AND NUMBER to be set in 30 pt. Stymie light, upper and lower case.

"DETAILED DESCRIPTION" to be set in 14 pt. Stymie light caps.

"LIST OF SECTIONS" and "PAGE No." to be set in 10 pt. Stymie light caps.

THE LISTING OF SECTIONS (number, name, and page) to be set in 14 pt. Futura bold, upper and lower case. All of the above materials is to be set as close as possible in style to that shown with sufficient leading and with the whole text block centered between the rules.

FOLIO NUMBER to appear on trim edge and bottom and to be set in 12 pt. Futura bold.

CLASSIFICATION to appear on binding side at the bottom and to be set in 12 pt. Futura bold caps.

NOTE.- Girder or Beton light or medium may be substituted for Stymie. Any other Sans Serif type of same weight may be substituted for Futura.

Chapter 2

DETAILED DESCRIPTION

LIST OF SECTIONS PAGE NO.

RESTRICTED

Name of book—Upper c... er left-hand pages, 14 pt. Futura medium caps.

SECTION 1

18 pt. Stymie medium caps.

1 pica

Description of Turbine

18 pt. Stymie medium upper and lower case.

(Give complete name plate data as part of the title of description of turbine, reduction, etc.)

2 picas

The general arrangement of the set is shown in Fig. 4. The turbine and pinion shafts are rigidly connected and supported by three bearings, two in the reduction-gear casing and one at the exhaust end of the turbine.

Primary Subheads—14 pt. Futura extra bold caps centered.

ROTOR

The bucket wheels, shaft, coupling flange, and balancing rings are all integral, being machined from a solid alloy steel forging. The pinion is bolted on one end of the turbine rotor and the emergency governor on the other. The rotor, complete with buckets, is balanced statically and dynamically at the factory.

1 pica

Balancing Rings

6 pt. spade

The coupling flange of the rotor is tapped on its outer periphery for radial balancing plugs. See photograph below. At the exhaust end, the shaft carries another integrally forged balancing ring, tapped for axial balancing plugs.

DYNAMIC BALANCING. Adjustment of the rotor for dynamic balance is accomplished by the insertion at the proper points in these rings of balancing plugs of the correct weight. The plugs, when threaded into their holes, are drawn flush with the outer shoulder, and the outer thread of the hole is staked over. See Fig. 31, page 26, for generator balancing rings.

All of the holes are filled initially with one-half inch screw plugs to minimize windage loss, and the balancing plugs are substituted where necessary. These plugs provide an accessible means of balancing when rebucketing the rotor. During inspection periods it is advisable to inspect all plugs to see that they are tight.

Buckets

The buckets on all the wheels are of corrosion-resisting steel, and are attached by T-head dovetails. The buckets are spaced by skirts at the dovetail, machined as an integral part. The buckets are banded together in sections by steel shroud bands riveted onto the buckets.

FIGURE 4. TYPICAL TEXT PAGE

A typical text page spread is shown here with type and spacing specifications noted. New sections may be started near the bottom of the page if the space allows a minimum of three lines of type in each column; tabulated matter may be run two columns or one column.

Fig. 4. Turbo-generator set as seen from turbine end, throttle-valve side

Classification—Inner bottom corner, 12 pt. RESTRICTED Futura bold caps.

Chapter Heading—Upper right-hand corner of right-hand pages, 14 pt. Futura medium caps.

1 pt. rule

1 pica

A shroud band of corrosion-resisting steel extends completely around the outer circumference of the buckets on each wheel. This band closes over the tops of the buckets and, by projecting slightly on each side of the buckets, aids in preventing steam leakage over the tops of the wheels.

The low-pressure end of the rotor carries an emergency governor assembly. The housing of the assembly is machined to receive a ratchet wrench for turning the rotor by hand. A wrench for this purpose is furnished with the units.

NOZZLE PLATE

The cast steel first-stage nozzle plate (3), Fig. 2, is bolted to and calked in the upper half of the high-pressure head. The nozzle plate contains a series of recessed nozzles opening into ports on the high-pressure side.

Nozzle Diaphragms

The five nozzle diaphragms are made of steel with welded corrosion-resisting steel nozzle partitions.

Secondary Subheads—14 pt. Futura extra bold upper and lower case, flush left.

Mounting

Because of the high steam temperature at the inlet end of the casing, the second-stage diaphragm is supported at the center line to allow for radial expansion.

SECOND-STAGE DIAPHRAGM. The lower half of the second-stage diaphragm is further positioned by the centering dowel (7) in the bottom of the casing. Crush pins (4) around the periphery of the diaphragm assist in holding both halves securely in place.

2½ picas

SECTION 2

Description of Speed Reducing Gear

2 picas

The reducing gear is the single-reduction, single-helical type, and reduces the turbine speed of 10,059 r. p. m. to the generator speed of 1,200 r. p. m.

PINION

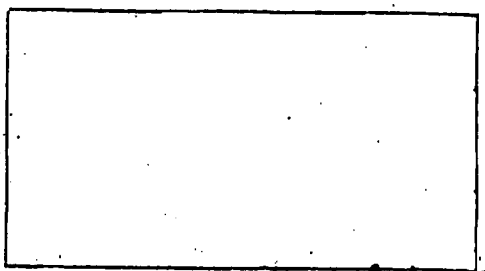
The pinion is forged integral with the shaft. One end of the shaft is provided with a flange that bolts rigidly to the turbine shaft and through which one end of the turbine rotor is supported. The other end of the pinion shaft has an extension, on which is assembled the thrust bearing. The complete assembly is shown in Fig. 6.

GEAR WHEEL

The gear wheel is a steel forging and is pressed and keyed on a forged steel shaft. One end of the gear shaft is solidly coupled to the generator shaft, and part of the weight of the generator rotor is carried by the gear bearing at that end. The turbine end of this shaft is extended to carry the spiral gear that drives the oil pump and the governor.

GEAR CASING

The gear casing consists of two halves which are jointed at the horizontal center line of the rotors. The bearing seats for supporting the gear and pinion bearings, the oil pump seating, and the supports for the high-pressure end of the turbine are fabricated integral with the lower half of the casing.



6 pt. space

FIG. 5—*View of the pinion showing half of the solid coupling, which is bolted to the turbine rotor*

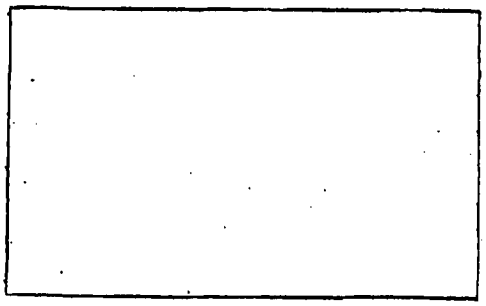


FIG. 6—*Reducing gear with upper half casing removed showing the pinion and gear wheel assembled in their operating positions* Captions—Italic of text.

Folio—Outer bottom corner, 12 pt.

FIGURE 5. TYPICAL GATEFOLD OR FOLD-IN PAGES

The following four pages illustrate correct style that may be followed in gatefold pages where oversize illustrations or blueprints are to be used. Fold-over pages, double, or triple pages will be permitted only for illustrations where essential to insure legibility.

ENGINE THROTTLE CONTROL

DESCRIPTION

The engine throttle control system is made up of a series of linkages which, in direct connection with a hydraulic system, enable the operator to start and operate the engine at any required speed. (Fig. 3.) For complete understanding the following description is essential:

1. A mechanical linkage sets the limit to which fuel can be injected.
2. The engine throttle control sets the operating fuel pressure of the fuel pump.
3. A mechanical linkage from the control governor operates the control shaft which is coupled to the fuel injectors.
4. The hydraulic system, in conjunction with the linkage system, operates the control governor regulator shaft.
5. The throttle control operates the limit switch which controls the electrical circuit of the brake on the propeller shaft, just aft of the reduction gear.

The engine throttle control system is actuated by the movement of the throttle lever, or handle, of the hydraulic transmitter, which is located on the after side of the engine control box. (Fig. 1.) When the throttle lever is in the extreme out position, the hydraulic transmitter and receiver units are synchronized. (This function will be explained in detail later in this section.)

As the throttle handle is moved inward, beyond the synchronizing stage, it reaches the point where, for a few degrees of travel, it operates the air starting system (Section 20); When the air starting system is functioning, no fuel is admitted into the cylinders; however, at the instant when the throttle handle is moved farther inward and the air starting valve is released, fuel oil is then injected into the cylinders, and the engine begins to operate under its own power. Continuing the inward movement of the throttle handle increases the amount of fuel oil which is injected into the cylinders, and thereby increases the speed and power of the engine (Section 4).

The serrated shaft of the transmitter is linked with the throttle shaft which, in turn, is directly linked with the throttle lever tube. The throttle shaft is supported in two bronze bearings which are bolted to pads on the cylinder block, just below the camshaft trough. (Fig. 3.)

The throttle lever tube floats on the control shaft, and a lever attached to it is connected with the regulating adjusting lever of the fuel oil pump. A spring loaded piston and cylinder assembly is built into the regulating adjusting lever, and its function is to permit the throttle shaft to pass through the synchronizing and air starting stages without moving the fuel pump pressure regulating lever. This permits the regulating lever to be moved from its idling position to maximum engine load position. A pin lever, welded to the throttle lever tube, sets a position beyond which the control lever on the control shaft cannot advance. Therefore, the control lever cannot be advanced beyond the throttle setting, and no additional fuel oil will be injected into the cylinders until the throttle is advanced farther. The control lever rides on the pin lever of the throttle lever tube, unless the automatic function of the governor tends to hold it away from the pin lever.

The two fuel injectors are synchronized and are coupled by the intermediate control shaft. The after fuel injector is coupled to the control shaft, which is supported at the opposite end by a ball bearing in a bracket attached to the camshaft gear cover.

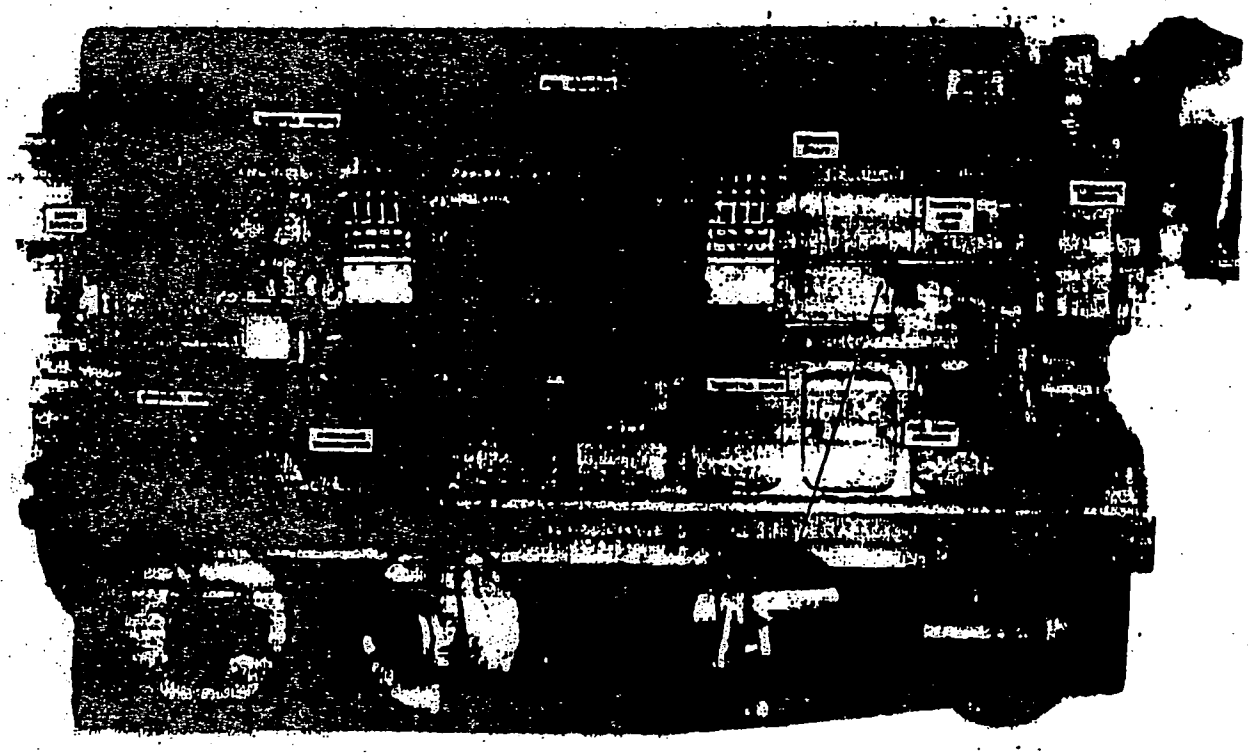


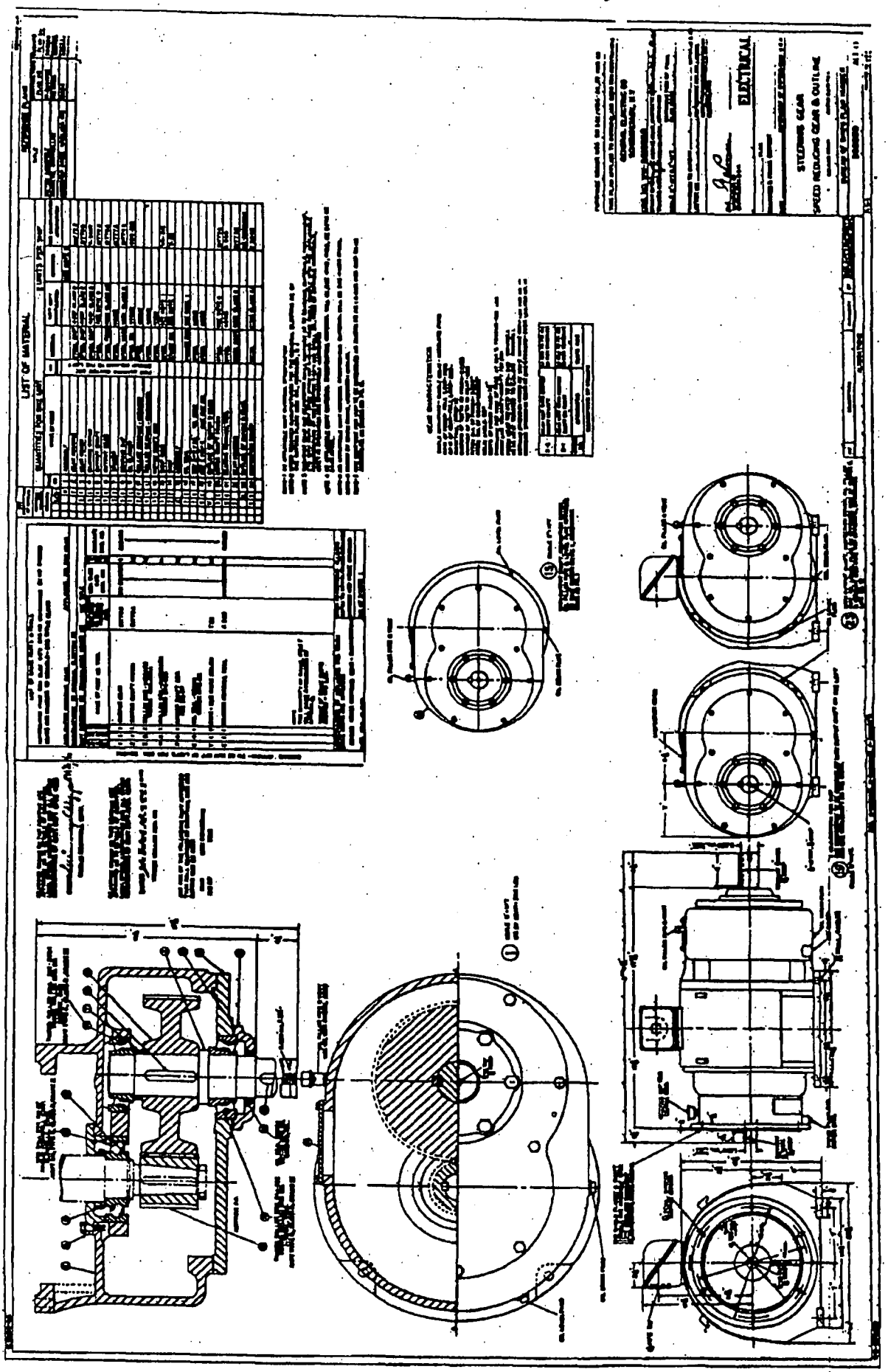
Figure 3 - Engine Control System

STEERING GEAR
DD692 Class

LIST OF REPAIR PARTS AND SPECIAL TOOLS

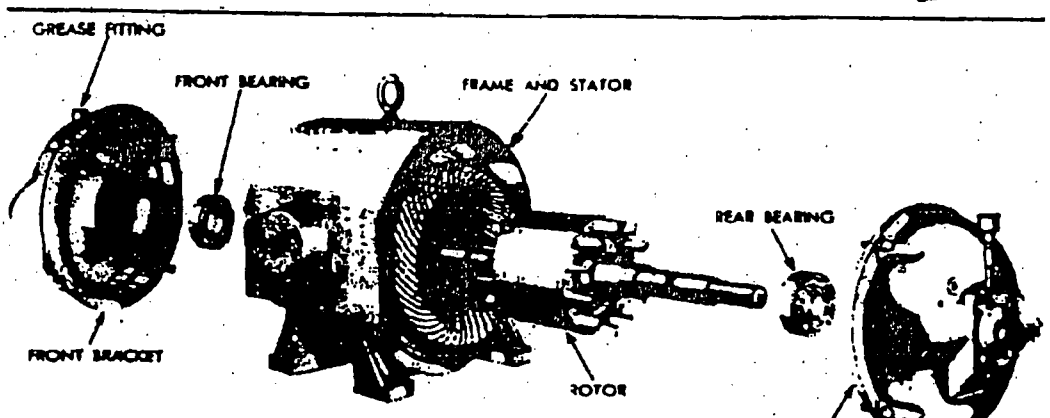
Item No.	No. Items	Description	Mfrs. Service Part No.	Plate No.	Mfrs. DFC No.	Bureau Dwg. No.
1	1	Output Gear	21778A	6	WW8019999	566039
2	1	Motor Shaft Pinion	21779A	20	"	"
3	2	Roller Bearing—Inboard Timken 558–552A		10	"	"
4	2	Roller Bearing—Outboard Timken 644–632		11	"	"
5	2	Motor Shaft Bearing—SRB 313MF		12	"	"
6	4	Oil Seal—40950 Victor Mfg Co.		16	"	"
7	1	Shim—See Note Below	T22	14	"	"
8	1	Bearing Removal Tool	K508	21	"	"

Note: The quantity of shims, item 7, will make a thickness of approximately 1/16".

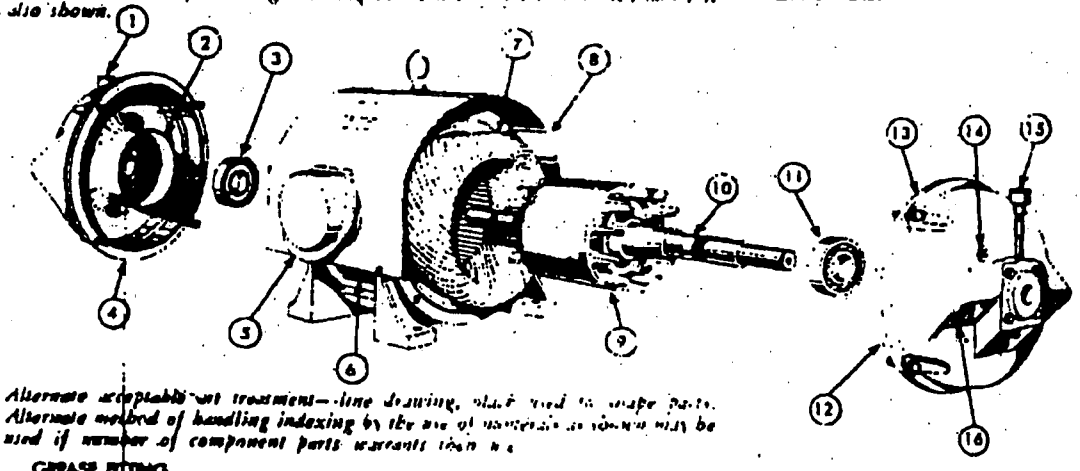


ART TREATMENT FOR EXPLODED VIEWS

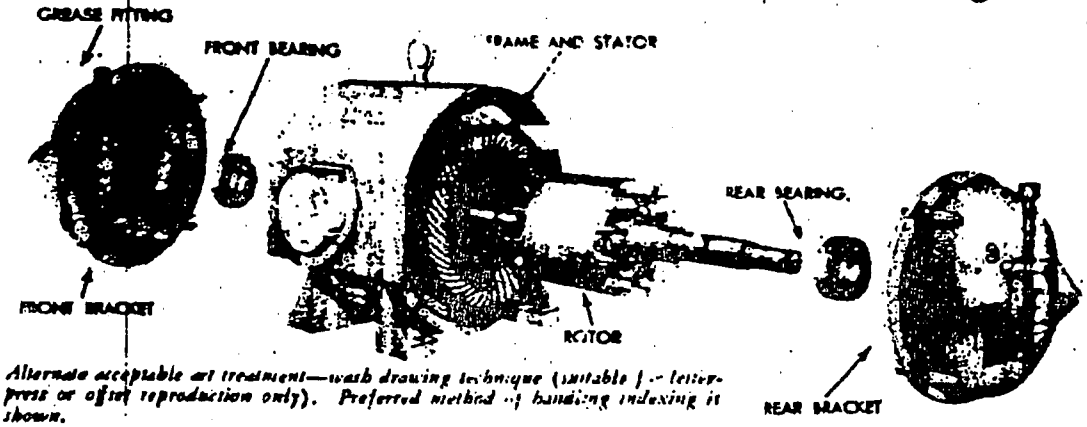
Fig. 6



Preferred art treatment for exploded views—line drawing with shading medium. Preferred method of handling indexing by the use of [illegible] also shown.



Alternate acceptable art treatment—line drawing, [illegible] Alternate method of handling indexing by the use of numerals as shown may be used if number of component parts warrants them.



Alternate acceptable art treatment—wash drawing technique (suitable for letterpress or offset reproduction only). Preferred method of handling indexing is shown.

NOTE.—Where letterpress or offset reproduction is to be employed, well-retouched photographs, exploded as per drawing shown above will also be acceptable.

8-11640

FIGURES 7 AND 8

These figures show approved style to be followed on manuals which are to be typewritten, varityped, or set with the electromatic typewriter. All copy should be prepared to allow for a 15- or 20-percent reduction in size.

TITLE OF BOOK

MFR'S NUMBER

Fig .7

PART I

DESCRIPTION OF TURBINE AND GEAR

GENERAL ARRANGEMENT

The design of the turbine and arrangement of the main parts are shown in the assembly drawing, Fig. 2. The turbine, as well as the gear and generator, is mounted on a rigid steel base as indicated in the outline, Fig. 1. The exhaust end of the turbine is carried from the base on vertical supports which are rigid in a cross-axis direction but are flexible in an axial direction thereby allowing for axial expansion of the turbine casing under load conditions. The high-pressure end of the turbine is bolted rigidly to the gear casing.

SECTION I

DESCRIPTION OF TURBINE

The throttle valve is provided with both a handwheel for manual control and an emergency tripping device. The throttle valve will be tripped closed automatically by an emergency governor.

ROTOR AND BUCKETS

The turbine rotor (1), Fig. 2, consisting of shaft, bucket wheels, and coupling, is machined from a solid steel forging. The coupling flange of the rotor is tapped around its outer per- for balancing plugs.

The throttle valve is p- handwheel for manual contro tripping device. The thrott tripped closed automatically -ergency governor.

THIS PAGE WAS TYPED USING 36C-B FOR BODY AND GOTHIC TYPES 22B, 27B AND 18GL BOLD FOR THE VARIOUS HEADINGS.

Buckets

The buckets of all six wheels are made of corrosion-resisting steel. They are secured to the periphery of each wheel by dovetails. The spacing of the buckets around the wheels is determined by skirts at the dovetails. The skirts form a part of the buckets.

A shroud-band of corrosion-resisting steel extends completely around the outer circumference of the buckets on each wheel. This band closes over the tops of the buckets and, by projecting slightly on each side of the buckets, aids in preventing steam leakage over the tops of the wheels.

The low-pressure end of the rotor carries an emergency governor assembly. The housing of the assembly is machined to receive a ratchet wrench for turning the rotor by hand. A wrench for this purpose is furnished with the units.

NOZZLE PLATE

The cast steel first-stage nozzle plate (3), Fig. 2, is bolted to and caulked in the upper half of the high pressure head. The nozzle plate contains a series of reamed nozzles opening into ports on the high-pressure side.

NOZZLE DIAPHRAGMS

The -ozzle diaphragms are made of steel -rrosion-resisting steel nozzle par- the diagram five nozzle dia- made of steel with welded corrosion- -ing steel nozzle partitions.

Mounting

Because of the high steam temperature at the inlet end of the casing, the second-stage diaphragm is supported at the centerline to allow for radial expansion.

SECOND STAGE DIAPHRAGM. The lower half of the second stage diaphragm is further positioned by the centering dowel (7) in the bottom of the casing. Crush pins (4) around the periphery of the diaphragm assist in holding both halves securely in place.

LOCATION OF DIAPHRAGMS. The other four diaphragms, which are located in the exhaust casing are mounted as shown in Fig. 3b. The cast steel first-stage nozzle plate (3), Fig. 2 is bolted to and caulked in the upper half of the high pressure head.

The first stage is drained through a valve at the bottom of the casing.

TURBINE CASING

The turbine casing consists of a steel high-pressure head (4), Fig. 2, and a steel exhaust casing.

CLASSIFICATION

MFR'S NUMBER

TITLE OF BOOK

PART 1

DESCRIPTION OF TURBINE AND GEAR

Fig. 8

GENERAL ARRANGEMENT

The design of the turbine and arrangement of the main parts are shown in the assembly drawing, Fig. 8. The turbine, as well as the gear and generator, is mounted on a rigid steel base as indicated in the outline, Fig. 1. The exhaust end of the turbine is carried from the base on vertical supports which are rigid in a cross-axis direction but are flexible in an axial direction thereby allowing for axial expansion of the turbine casing under load conditions. The high-pressure end of the turbine is bolted rigidly to the gear casing.

SECTION 1

DESCRIPTION OF TURBINE

The throttle valve is provided with both a handwheel for manual control and an emergency tripping device. The throttle valve will be tripped closed automatically by an emergency governor.

Rotor and Buckets

The turbine rotor (1), Fig. 8, consisting of ... els, and coupling, is machined from a solid steel forging. The coupli- ... is tapped around its outer periphery for balancing plugs.

THIS PART WAS TYPED USING STANDARD ELITE TYPE, PENDING 196

The throttle valve is provid... ...al for manual control and an emergency tripping device. The throttle ... closed automatically by an emergency governor.

Buckets

The buckets of all six wheels are made of corrosion-resisting steel. They are secured to the periphery of each wheel by dovetails. The spacing of the buckets around the wheels is determined by skirts at the dovetails. The skirts form a part of the buckets.

A shroud-band of corrosion-resisting steel extends completely around the outer circumference of the buckets on each wheel. This band closes over the tops of the buckets and, by projecting slightly on each side of the buckets, aids in preventing steam leakage over the tops of the wheels.

The low-pressure end of the rotor carries an emergency governor assembly. The housing of the assembly is machined to receive a ratchet wrench for turning the rotor by hand. A wrench for this purpose is furnished with the units.

Nozzle Plate

The cast steel first-stage nozzle plate (3), Fig. 8, is bolted to and caulked in the upper half of the high pressure head. The nozzle plate contains a series of reamed nozzles opening into ports on the high-pressure side.

Nozzle Diaphragms

The five nozzle diaphragms are made of steel with welded corrosion-resisting steel nozzle partitions. All of the diagrams five nozzle diaphragms are made of steel with welded corrosion-resisting steel nozzle partitions.

Mounting

Because of the high steam temperature at the inlet end of the casing, the second-stage diaphragm is supported at the centerline to allow for radial expansion.

CLASSIFICATION

8-11640

FIGURE 9 - TYPICAL COVER - TYPE D BOOKS

BUREAU IDENTIFICATION AND NUMBER OF PUBLICATION appears in upper left-hand corner in letters 3/16 inch high.

SECURITY CLASSIFICATION, if applicable, (See 3.2.12) appears in upper right-hand corner in letters 3/16 inch. (Security Classification in this case is "Restricted").

TYPE OF BOOK in letters 1/4 inch high

SPECIFIC TITLE OF BOOK in letters 3/8 inch high.

BUREAU STANDARD STOCK NUMBER (if assigned) to be set under title of book in letters 3/16 inch high.

CONTRACT NUMBER in letters 3/16 inch high.

MANUFACTURER'S NAME AND ADDRESS in letters 1/8 inch high.

NAME OF BUREAU, NAVY DEPARTMENT, WASHINGTON D.C. to be set at bottom of page in letters 1/8 inch high.

SECURITY CLASSIFICATION, if applicable, (See 3.2.12) appears in lower right-hand corner in letters 3/16 inch high.

NAVSHIPS 000-0000

RESTRICTED

INSTRUCTION BOOK

DIESEL OIL BURNER
RAY TYPE AG 23, SIZE 0000
FOR 110V-60 CYCLE A.C.

BUSHIPS STK. NO. S65-B-2749-200

CONTRACT NOBS-00000

RAY OIL BURNER COMPANY
SAN FRANCISCO, CALIFORNIA

BUREAU OF SHIPS - NAVY DEPARTMENT - WASHINGTON, D.C.

RESTRICTED

B-11640

EXHIBIT C

Exhibit C

TO THE AFFIDAVIT OF ADMIRAL HORNE

MIL-T-15071B(NAVY)
18 August 1954
SUPERSEDING
MIL-B-15071A(NAVY)
20 October 1948

MILITARY SPECIFICATION

TECHNICAL MANUALS FOR MECHANICAL

AND ELECTRICAL EQUIPMENT

1. SCOPE

1.1 Scope. - This specification covers technical manual requirements for electrical and mechanical equipment.

1.2 Classification. - Technical manuals shall be of the following types as specified (see 6.1):

Type A - (Type A manuals may be required where the system or equipment to be described is of a highly specialized or extremely complex nature, and where the importance of the equipment justifies unusual effort in the preparation of the manual.) (See 3.3.)

Type B - (Type B manuals are required where the equipment or system to be described has no direct commercial counterpart or which is sufficiently complex that a detailed description, and maintenance instructions are required and must be supplemented by sufficient photographs, drawings, parts lists, etc.) (See 3.5.)

Type C - (Type C manuals are required where the equipment or system to be described is an adaptation or variation of conventional commercial equipment, where with certain modifications and additional data, the type of instructional matter normally furnished will serve the purpose.) (See 3.6.)

Type D - (Type D manuals are required where the equipment or system to be described is generally the same as equivalent commercial equipment, or is sufficiently simple that standard manufacturer's instruction pamphlets and service data are adequate.) (See 3.7.)

2. APPLICABLE DOCUMENTS

2.1 The following specifications and drawings, of the issue in effect on date of invitation for bids, form a part of this specification:

SPECIFICATIONS

MILITARY

MIL-R-15137 - Repair Parts for Electrical and Mechanical Equipment (Naval Shipboard Use).

NAVY DEPARTMENT

General Specifications for Inspection of Material.

DO NOT [illegible]

DRAWINGS

BUREAU OF SHIPS
Bu Ships 78726 - Standard Drawing Format for Production Drawings Prepared by Contractor or Manufacturer for Approval by Government Agency.

(Copies of specifications, standards, drawings, and publications required by contractors in connection with specific procurement functions should be obtained from the procuring agency or as directed by the contracting officer.)

3. REQUIREMENTS

3.1 Material. - The minimum material requirements are as specified hereinafter. A good grade material shall be used when a definite material is not specified.

3.2 Distribution required. - Distribution shall be as follows except when identical manuals have been previously distributed to all the addressees:

(a) Two copies packed with each unit of equipment (for ultimate placement onboard ship) [see 3.4.5].
(b) Four copies to the Bureau of Ships.
(c) Two copies to the cognizant Supervisor of Shipbuilding.
(d) One copy to the cognizant Inspector of Naval Material.
(e) One copy to the Director, Naval Engineering Experiment Station, Annapolis, Maryland (propulsion machinery and major auxiliary equipment only).
(f) One copy to the Superintendent, U.S. Naval Academy, Postgraduate School, Monterey, California, (propulsion units and major auxiliary equipment only).
(g) Two copies to each U.S. Naval Shipyard (except Portsmouth, N.H. - for Military equipment only).
(h) Two copies to each U.S. Naval Shipyard concerned (for non-Military equipment only).
(i) Two copies to Portsmouth Naval Shipyard (Submarine equipment only).
(j) One copy to the Submarine Supply Office, Philadelphia, Pa. (Submarine equipment only).
(k) Two copies to all Submarine Tenders (Submarine equipment only).
(l) Six copies to the Commander, Submarine Base, New London, Conn. (Submarine equipment only).
(m) Manuals for stock shall be specified generally in the following quantities:

Number of equipments	Number of copies
1 to 25	10 plus 2 per equipment
26 to 250	50 plus 2 per equipment
Over 250	100 plus 2 per equipment

Bulk copies of manuals furnished for stock shall be shipped to:

Commanding Officer
Naval Supply Depot
Mechanicsburg, Pennsylvania
"For ECCC stock"

(n) In addition to (a) through (m) above, the shipbuilder shall provide technical manuals for selected components and systems in the following minimum quantities to the Fitting Out Activity for placement onboard the ship:

	Heavy cruisers and larger type ships	Smaller ships	Small craft and submarines
Engineering piping systems	50	25	6
Propulsion prime movers	10	5	1
Propulsion reduction gears	10	5	1
Boilers, main	10	5	1

	Heavy cruisers and larger type ships	Smaller ships	Small craft and submarines
Diesel generator sets	10	5	1
Distilling plants	10	5	1
Refrigeration plants	10	5	1
Gasoline handling systems	10	5	1
Submarine electrical propulsion equipment	—	-	1
Ships service switchboards and motor generator sets	—	-	1
Main storage batteries	--	-	1

3.2.1 For ships constructed under the Mutual Defense Assistance Program only, the requirements of 3.2 (a) through (m) do not apply. Manuals for equipment and systems peculiar to ships constructed under the Mutual Defense Assistance Program shall be distributed as follows:

(a) Six copies to the Military Assistance Advisory Group of each foreign Government assigned a ship of the class.
(b) One copy to the Washington, D.C. Naval Attache of the recipient Government.
(c) Four copies to the Bureau of Ships.
(d) One copy to the cognizant Supervisor of Shipbuilding.
(e) Two copies with each unit of equipment for placement aboard ship (see 3.4.5).
(f) One copy to the cognizant Inspector of Naval Material.
(g) Twelve copies to the Naval Supply Depot, Mechanicsburg, Pennsylvania.

Note.-- Military equipment is defined as the auxiliary machinery necessary for the operation, seaworthiness and combatant efficiency of the vessel. Nonmilitary equipment is defined as ranges, coffee making apparatus, food mixing machines, sterilizers, laundry machines, sewing machines, refrigerators.

3.3 Type A manuals.- Type A manuals shall be as specified in the individual contract or order.

3.4 General requirements for types B, C, and D manuals.-

3.4.1 Identification.- All manuals shall be identified by a Navy identification number of the form "NAVSHIPS 000-0000" (see figures 1 and 2). This number will be assigned by the bureau or agency concerned upon a receipt of a preliminary copy submitted for bureau or agency approval. In urgent cases, this number may be obtained by a written request, containing complete descriptive data of the equipment. This number shall be imprinted on the upper left-hand corner of the cover, and the upper right-hand corner of the fly-leaf of all manuals prior to distribution.

3.4.2 Reproduction copy.- If offset negatives are used in the publication of the technical manuals, a complete set of such negatives shall, after completion of the manuals, be delivered to the Naval Supply Depot, Mechanicsburg, Pennsylvania and shall remain the property of the Government for use in subsequent reproduction of the manuals. Regardless of the method of printing used, one glossy print or negative of each half-tone illustration included in the manuals, shall be delivered to the Naval Supply Depot, Mechanicsburg, Pennsylvania, and shall remain the property of the Government for use in subsequent reproduction of the manuals. This requirement does not apply to type D manuals (3.7) nor to manuals for which reproduction copy has been previously furnished.

3.4.3 Copyright.- Technical manuals shall not be copyrighted. The bureau or agency concerned reserves the right to reproduce or have reproduced in part or in entirety all manuals procured under this specification.

3.4.4 Security classification. - Unless otherwise specified in the contract or order, manuals shall be unclassified. If classified, notification of the classification shall appear on the front and back covers and each page of the manuals as shown on figures 1 to 8, inclusive. In addition, classified manuals shall have the following paragraph printed on the title page as shown on figure 8:

"WARNING: This document contains information affecting the national defense of the United States within the meaning of the Espionage Laws, Title 18, U.S.C., Sections 793 and 794. The transmission or the revelation of its contents in any manner to an unauthorized person is prohibited by law."

Classified manuals shall be marked with consecutive serial numbers beginning with number 1. Receipt cards shall be provided to all classified manuals. Each card shall contain the serial number of the manual in which it is included.

3.4.5 Revision to incorporate changes. - New, revised, or supplementary pages shall be furnished until the guarantee period expires. The quantity of pages furnished and the distribution shall be the same as for the manual provided in the original contract or order.

3.4.5.1 New pages. - When it is found necessary to include new information to augment the manual data, new pages shall be issued. These pages shall be identified with the following legend placed in the bottom outside corner, beside the page number and toward the binding edge of each page; on the first line, the word "New" followed by the NAVSHIPS identification number, and on the second line the month and year of issue. New pages shall bear the same number as the manual page they follow with the addition of a letter; for example, original page 6B, new pages 6Ba and 6Bb. A reproduction copy of each new page shall be provided.

4.4.5.2 Revised pages. - If it is determined that information originally furnished in manuals must be changed for clarification, correction, or because every equipment covered by the manual has been uniformly modified, revised pages shall be issued. These pages shall be identified with the following legend placed in the bottom outside corner, beside the page number and toward the binding edge of each page; on the first line, the word "Revised" followed by the NAVSHIPS identification number, and on the second line the month and year of issue. Revised pages shall bear the same number as the page they replace. A reproduction copy of each revised page shall be provided.

3.4.5.3 Supplementary pages. - In instances where modifications are made only to a certain number of the total number of equipments covered by the manual, resulting in the need for alternate instructions to cover those items modified, this information shall be issued in the form of supplementary pages. These pages shall be identified with the following legend placed in the bottom outside corner, beside the page number and toward the binding edge of each page; on the first line, the word "Supplementary" followed by the NAVSHIPS identification number on succeeding lines the hull numbers of the specific ships to which the page applies, and on the last line the month and year of issue. Supplementary pages shall bear the same number as the manual page they follow with the addition of a letter; for example, original page 6B, supplementary pages 6Ba, 6Bb. A reproduction of each supplementary copy shall be provided.

3.4.6 Time of delivery. - Two copies of the manuals shall be delivered with the first unit and each succeeding unit of equipment shipped except that no more than ten manuals for heavy cruisers and larger and no more than six manuals for smaller ships shall be considered necessary to fulfill this requirement when it is known the equipment is destined for a particular ship (see 3.3 for specific exceptions). If final manuals are not available at the time of delivery of the equipment, two copies of an adequate preliminary manual (see 3.4.7) shall be furnished to the Government inspector to fulfill the above requirements for shipment of manuals for each unit.

NOTE: The importance of delivering these manuals with each unit of equipment cannot be too strongly emphasized, since they are of great value in the installation of the equipment and in training and indoctrinating the ship's crew.

3.4.7 Preliminary manuals.-

3.4.7.1 Method of approval.- Prior to the printing of the final manuals, a preliminary manual shall be prepared and submitted in duplicate to the bureau or agency concerned via the Government inspector for approval and assignment of a Navy MAVSHIPS identification number. Every effort shall be made to submit the preliminary manual in ample time to permit approval and final printing prior to the delivery date of the equipment. Preliminary manuals shall be furnished in instances where final manuals are not available for delivery with the equipment. In all instances where preliminary manuals are furnished in lieu of final manuals, they shall be replaced with final manuals within 60 days (see 3.4.6 and 3.4.7.2.3).

3.4.7.2 Contents.-

3.4.7.2.1 Text.- Preliminary manuals shall consist of a complete text of the instructions required for the type of manual to be furnished.

3.4.7.2.2 Illustrations.- Preliminary manuals shall contain a list of all illustrations, (photographs, exploded views, drawings, and sketches) and sample art work (save photos and drawings but including all exploded views and sketches) which will appear in the final manuals. If the final manual is to include test data, or a table of weights, for example, and if any or all of the items are not available when the preliminary manual is issued, then a foreword shall list all items which have been omitted and which will appear in the final manual.

3.4.7.2.3 Manual identification.- In all instances where preliminary manuals are furnished in lieu of final manuals, the MAVSHIPS identification number shall be stamped on all copies of the preliminary manuals prior to distribution (see 3.4.1).

3.4.7.2.4 Covers.- Covers for preliminary manuals shall be at least 20 by 26-65/500-basis gray antique finish cover stock or similar material, hallows fold, with the title and other pertinent information on the cover. This information shall be identical with that which will appear on the final manual except that the word "preliminary" shall appear directly in front of the identification number (see 3.4.1).

3.4.7.2.5 Printing.- The text may be printed by any quick, economical method, such as multigraph, mimeograph or similar method.

3.5 Type B manuals.-

3.5.1 Contents.- Type B manuals shall contain the following information as applicable, presented in a logical arrangement (see figures 1 to 8, inclusive):

(a) Title page (see figure 2).
(b) General data (see 3.5.1.1).
(c) Table of contents, listing all divisions and primary and secondary subdivisions (such as chapters, sections) with the corresponding page numbers.
(d) List of illustrations and drawings, specifying titles, figure numbers and pages on which such illustrations appear.
(e) Introduction (see 3.5.1.2).
(f) Detailed description (see 3.5.1.3).
(g) Installation instructions (see 3.5.1.4).
(h) Adjustments and tests (see 3.5.1.5).
(i) Principles of operations (see 3.5.1.6).
(j) Operating instructions (see 3.5.1.7).
(k) Maintenance (see 3.5.1.8).

(l) Parts identification (see 3.5.1.9).
(m) Drawings (see 3.5.1.10 and 3.5.2.4.5.4).
(n) Memorandum pages (see 3.5.1.11).

Note.- Although these requirements are directly applicable to manuals covering specific equipment, they shall be followed as closely as possible for manuals covering systems, such as engineering piping systems. When a manual covers a system or an equipment composed of several distinct units (for example, a generating set consisting of a Diesel engine, a generator, a voltage regulator, and a controller), it may be desirable to arrange the manual in major divisions, each covering one unit. If so, the major divisions may be arranged by subdivisions, each corresponding to the requirements herein.

3.5.1.1 General data.- This division shall contain data such as the following:

(a) Safety notice (where high voltages or special hazards are involved) (see figure 2).
(b) Component list containing:
Description of item.
Navy type designation.
Standard Navy stock number.
Dimensions.
Weight (with or without packing).
(c) Input power requirements and heat dissipation.
(d) Salient design characteristics.
(e) Electron tube complement.
(f) Serial number (if appropriate).

3.5.1.2 Introduction.- This division shall include a general description of the equipment; explain briefly what it is, where it is used, and what it will do, also all information of a general character applicable to the complete equipment. When the text contains technical terms or terms not commonly used, definitions shall be included.

3.5.1.3 Detail description.- This division shall contain a complete detailed description of component assemblies and accessories which comprise the complete equipment; for example, in the case of a ship's service turbine generator set, the turbine, the gear, the generator, the exciter, and the voltage regulator. Allowable clearances, temperatures or tolerances shall be shown in tabular form.

3.5.1.4 Installation instructions.- This division shall contain methods of installation, alignment, precautions, mounting instructions, recommendations regarding shielding, grounding or bonding.

3.5.1.5 Adjustment and tests.- This division shall contain instructions for the adjustment and test of the system and its major components upon initial installation or under other conditions such as after major overhaul where complete system readjustment may be required.

3.5.1.6 Principles of operation.- This division shall contain a brief resume of the principles of operation together with such illustrations, sketches, schematic piping diagrams and schematic wiring diagrams to convey an understanding of the function and operation of the equipment. Descriptions of components and assemblies using electron tubes should provide an explanation of the electronic circuits. A preferred method of describing electronic circuits is to present the description in sections, such as amplifier features, power circuits, main radio transmission path and mechanical arrangements. Theory of operation should be included where unusual or unconventional circuits or techniques are involved.

3.5.1.7 Operating instructions.- This division shall contain simple, brief and effective instructions, including normal routines and precautions such as maximum and minimum loads, normal temperature or pressure limits, to be observed in starting, operating and shutting-down the equipment. Where operations are to be performed in specific sequence, step-by-step procedures shall be used. Operations shall be numbered in the order in which they are to be performed. Operating data which is frequently referred to in operating the equipment shall be included in this division. Tables and charts shall be used for the presentation of these instructions where varying operating conditions are encountered.

3.5.1.8 Maintenance instructions.-

3.5.1.8.1 Preventative maintenance.- This division shall cover all maintenance procedures, inspection and routine adjustments which should be performed periodically and regularly for the purpose of preventing failure or impairment of equipment. Included in this division shall be routine maintenance check charts containing the following:

(a) A tabulation of periodic routine mechanical and electrical tests and checks which should be accomplished regularly to insure continuity of service at peak performance.
(b) Arrangement of the table shall be such as to indicate what is to be done, when it is to be done and how to do it.
(c) Emphasis shall be placed upon the test facilities which may be incorporated in the various components.
(d) Instructions shall be provided for the care, inspection and cleaning of all particular parts.
(e) Instructions on lubrication shall be provided as applicable, preferably in chart form. They shall include information regarding lubrication recommended by the manufacturer, the type of lubricant to be used, together with specific time periods. Lubricants shall be described by military specification numbers where applicable and by commercial designations.
(f) Instructions shall be included stressing the importance of properly maintaining any safety devices, interlocks, provided to prevent damage to equipment or injury to personnel.

3.5.1.8.2 Corrective maintenance.- This division shall cover all information necessary to permit a technician to locate trouble and to make repairs or adjustments to each component, assembly or sub-assembly of the equipment. Included in this division shall be the following:

(a) Trouble shooting guides for the localization of faults giving possible sources of trouble, the symptoms, probable cause, and instructions for remedying the faults.
(b) Complete instructions on signal tracing for electric and electronic circuits, use of test instruments and other common servicing techniques.
(c) Ample illustrations, photographs, exploded views giving details of mechanical assemblies, and simplified schematic diagram of the electric circuits. Illustrations contained in other divisions may be used and referred to under this division without duplicating them.
(d) Voltage and resistance diagrams or tables for each electronic assembly showing normal voltages (with and without audio signal) and resistances as measured at the terminals of each tube socket and at other significant points in the circuit.

3.5.1.8 Parts nomenclature.- This division shall contain identification data covering all repair parts (parts and assemblies which are wearable or expendable during normal repair) to facilitate ready identification of parts for replacement and ordering purposes. This data shall be presented in one of the three following alternate arrangements:

(a) Parts list and illustrations.- Where the manual does not include reduced size drawings which are prepared in accordance with the standard drawing format shown on Drawing 801C3-73729, listing all repair parts, the parts identification shall be in the form of a parts list with illustrations, arranged as specified in 3.5.1.8.1 and 3.5.1.8.2.
(b) Drawings and illustrations.- Where the manual includes reduced size drawings which are prepared in accordance with the standard drawing format shown on Drawing 801C3-73729 (see figure 5) listing all repair parts, and where only mechanical parts are involved, the parts identification shall be in the form of illustrations to supplement the lists of material on the drawings. Illustrations shall be prepared for each assembly, subassembly and their component repair parts in accordance with 3.5.1.8.2 except that the index numbers shall be identical with the piece numbers assigned on the above drawings. Appropriate notes shall be added to these illustrations referring to the drawings on which the assigned numbers are listed.

(c) Drawings, illustrations and functional listing.- Where the manual includes reduced size drawings which are prepared in accordance with the standard drawing format shown on Drawing 803-73729, and which list all repair parts, and where electrical or electronic parts are involved, the parts identification shall be in the form of a functional listing of electrical and electronic parts with illustrations to supplement both the functional listing and the list of materials on the drawings. The functional listing of all electrical and electronic parts shall be prepared in accordance with 3.5.1.9.1.3.2. Illustrations shall be prepared for each assembly, subassembly and the component repair parts thereof in accordance with 3.5.1.9.3, except that the index numbers shall be identical with the place numbers assigned on the above drawings (for mechanical parts) and with the reference designation assigned on the schematic wiring diagram (for electrical or electronic parts) appropriate notes shall be added to these illustrations referring to the drawings on which the assigned numbers are listed.

3.5.1.9.1 Parts list.-

3.5.1.9.1.1 Contents.- The parts list shall contain the following information:

(a) List of illustrations by figure and page number.
(b) Introduction.
(c) Parts tabulation.
(d) Special tools.
(e) Numerical index of part numbers.

3.5.1.9.1.2 Introduction.- This division shall contain sufficient instructions to explain the following:

(a) Any symbols used therein.
(b) The general system of group assemblies in relation to the complete article.
(c) All cross-index systems employed.
(d) Titles or other markings intended to segregate different models.
(e) Other information as may be required to facilitate rapid and accurate use of the parts list.

3.5.1.9.1.3 Parts tabulation.- The parts tabulation shall contain the following information:

3.5.1.9.1.3.1 Tabulation for mechanical parts.-

(a) Figure number. This shall denote the illustration number wherein the part has been shown.
(b) Index number. This shall denote the index number covering the complete main or subassembly as listed in the catalog.
(c) Name of part and brief description.
(d) Number required.
(e) Unit of issue.
(f) Contractor's service part number.
(g) Actual manufacturer's name.
(h) Actual manufacturer's service part number.
(i) Standard Navy stock number assigned in accordance with specification MIL-R-18137.

3.5.1.9.1.2.8 Tabulation for electrical and electronic parts.-

(a) Figure number. This shall denote the illustration number wherein the part has been shown.
(b) Reference designation assigned in the schematic wiring diagrams.
(c) Name of part and brief description (including electrical ratings).
(d) Function. The function shall consist of a brief statement of use, purpose or the function of the part in the component.
(e) Military type number (where applicable).
(f) Actual manufacturer's name.
(g) Actual manufacturer's service part number.
(h) Standard Navy Stock Number assigned in accordance with Specification MIL-N-16137.

3.5.1.9.1.4 Special tools.- This division shall contain a list of all special tools supplied with the equipment showing the quantity, unit of issue (each, pair, set), description, and manufacturer's identification number.

3.5.1.9.1.5 Numerical index of part numbers.- This index shall list all items contained in the parts tabulation, arranged in a logical numerical sequence. These items shall be so arranged that column 1 of the index will give the manufacturer's part number and column 2 will give the illustration index number or numbers in which the part appears.

3.5.1.9.2 Illustrations.- A view of each assembly, subassembly and the component parts thereof shall be shown. Identification of illustrated parts with the listed parts shall be facilitated by the use of key or index numbers which will identify all the parts in the group assembly listing.

3.5.1.9.2.1 Illustrations of the exploded type may be used. When the use of exploded views is not practical, simple cross-sectional views may be used. The cross-sectional drawings when used for this purpose preferably shall be approved drawings or excerpts from approved drawings, and shall show both the manufacturer's drawing number and the drawing number of the bureau or agency concerned. In case no applicable approved drawing is available, cross-sectional views from manufacturer's drawings may be used.

3.5.1.9.2.2 A figure number and proper identifying caption shall appear with each illustration. In the case of subassemblies or sub-assemblies, the caption shall also identify and give the index number of the complete assembly as it appears in the parts tabulation.

3.5.1.9.2.3 An index number with an arrow to the item, part, or tool to which it pertains shall be used in illustrations. In cases where an assembly is exploded into its component parts, one or more of which require further explosion, the primary explosion shall be referenced by the use of numerals only. The subassembly shall be referenced by the basic number of the part as it appears in the primary assembly but each exploded part shall have an alphabetical designation, suffixed to the number of the primary part. The sequence of numerical and alphabetical designations shall correspond to the order of removal upon disassembly, wherever practicable.

3.5.1.9.2.4 Index numbers and arrows shall be used on each illustration to identify repair parts only.

3.5.1.10 Drawings.- This division shall contain reproductions of approved drawings, additional block diagrams, exploded views or explanatory drawings, as necessary to supplement the descriptive matter contained in the text. Wherever feasible, such diagrams, exploded views and sketches should be inserted in the text as close as possible to that portion of the text to which they apply. Diagrams of switches and relays used in the system showing the terminal numbering shall be inserted as additional drawings. The standard color codes for resistors and capacitors shall be stated, where applicable.

3.5.1.11 Memorandum pages.- Five blank pages shall be inserted at the end of the manual for memorandum purposes.

3.5.2 Format.-

3.5.2.1 Divisions (chapters or sections).- Divisions of manuals shall be by chapters or sections, numbered or lettered consecutively. In general, chapters shall be the main divisions of larger manuals and sections shall be the main division of smaller manuals. Chapters shall be further divided into sections which shall be numbered or lettered consecutively within the chapter. Where chapters are used, the first page of each chapter shall be arranged as shown on figure 3.

3.5.2.2 Page identification and numbering.-

3.5.2.2.1 At the top of each left-hand page, flush with the outside margin, shall appear a briefed title of the manual. At the top of each right-hand page, flush with the outside margin, shall appear the division, chapter or section number followed by its title. In some cases, it may be necessary to brief the title.

3.5.2.2.2 With the exception of fold-over pages and as otherwise specified herein, pages of the manuals shall be numbered consecutively in the bottom outside corner of each page, using Arabic numerals. The first page of chapter 1 or section 1 shall be page 1. All odd-numbered pages shall appear as right-hand pages. Fold-over pages shall be right-hand pages, and when they are used within the text they shall be assigned two page numbers, and the numbers shall be printed on the face of the sheet. Fold-over pages shall be arranged so that page numbers are visible without unfolding. Fold-over arrangements are shown on figure 5.

3.5.2.2.3 In manuals arranged for a system or equipment composed of several distinct units (see para number 3.5.1) the pages may be consecutively numbered within each chapter (or section), the first page of each chapter (or section) being page 1. In this case, the page number shall also include the chapter number. The chapter number shall appear first.

3.5.2.3 Layout treatment.- The layout of the manuals shall be such as to conserve space without detracting from the usability or clarity of material presented. Blank pages and spaces shall be avoided wherever possible except as specified in 3.5.1.11. Textual material shall be printed on both sides of the page. Illustrations serving no instructional function or to which no reference is made in the text shall not be used. Partial page illustrations within the text are highly desirable. Several small illustrations may be grouped to form a single page layout. Wherever possible, illustrations shall be located so that reference can be made from applicable text without turning a page. Fold-over pages, double, or triple pages will be permitted only for illustrations where this procedure is essential to insure legibility. Fold-over pages shall be used primarily in the back of the manual for the purpose of reproducing the drawings. Whenever it is desirable to include fold-over pages with the text in the front of the manual, such fold-over pages shall not be backed up with text or illustrations. All drawings which will be used for reference purposes while reading the text shall be provided with a blank section of the same size as a page at the left hand edge of the drawing (see figure 5). This will permit the drawing to be withdrawn clear of the manual while the text is being studied. Drawings shall be reproduced on a page the same height as other pages in the manual, in order that all folds will be parallel to the bound edge of the manual.

3.5.2.4 Text.-

3.5.2.4.1 Tables and charts.- The use of tables and charts is desirable. Such tables and charts shall not be elaborate or complicated, and sufficient explanation shall be given to make them easily understood.

3.5.2.4.2 Reference to figures.- Where reference is made to figures, the reference shall be to the figure number. The page number shall not be used except when the illustration is located more than three pages away from the reference. Where reference is made to items shown on figures by index numbers, figure number and index number shall be indicated as follows: "Remove nut (7) and drive out bolt (16) (see figure 6)."

3.5.2.4.3 Numbers. - Numbers from one to nine, inclusive, appearing in the text for the purpose of stating quantities shall be spelled out. All other numbers shall be shown as numerals except when they are used at the beginning of a sentence, in which case they shall be spelled out and followed by the numeral in parenthesis.

3.5.2.4.4 References to materials. - All materials required for maintenance referred to in the manual, such as lubricants, sealing materials or abrasives, shall be described by military specification numbers where applicable.

3.5.2.4.5 Illustrations. - Illustrations (including photographs, exploded views, drawings and sketches) shall be well planned and executed. They shall enable immediate and thorough comprehension of the subject.

3.5.2.4.5.1 Illustration identification. - Illustrations shall be identified by figure number and a title. Identifying figure numbers and titles shall be positioned immediately beneath the illustration. Whenever reduced size reproductions of drawings are used as illustrations, the drawing number shall be shown as well as the figure number.

3.5.2.4.5.2 Photographs. - Photographic illustrations shall be prepared with equipment capable of reproducing all details and shall show clearly the subject matter. Photographs shall be uniformly retouched to define shapes, accentuate details, and establish correct tone value of sufficient contrast for photolithographic reproduction.

3.5.2.4.5.3 Exploded views. - Exploded views may be used for showing the component parts of a subject. Well retouched photographs in which sharp contrast is interspersed to insure distinct detailed separation of parts may also be used for this purpose. It is preferable that all parts be exploded on their functional axis.

3.5.2.4.5.4 Drawings. - When drawings are necessary to illustrate the description, operation, and maintenance of the equipment or system, they shall be reduced in size as necessary (see figure 5), and reproduced in black and white. Each drawing shall be identified with the drawing number of the manufacturer and the bureau or agency concerned. Drawings shall be bound into the manual as shown on figure 5 (see also 3.5.2.3). Drawings shall normally be placed in the back of the manual but they must be inserted close to the references when practicable. Care shall be taken in the preparation of drawings for reproduction in the manual to insure that when the drawings are reduced in size they shall be clear and legible.

3.5.2.4.5.5 Sketches (see figure 6). - (NOTE: This paragraph does not pertain to reduced-size reproduction of standard approved drawings nor to portions of these drawings which may be extracted and used as illustrations in a manual.)

3.5.2.4.5.5.1 The rendering of sketches (airbrushing or line rendering) shall be done with the highest possible contrast. Adjoining areas of an illustration having similar values are to be avoided. Edges of all silhouette half-tone illustrations shall be sharply defined by retouching.

3.5.2.4.5.5.2 Exploded views and cutaway views shall be drawn in perspective to appear as realistic as possible without distortion. Isometric views may be used for small parts or units which lend themselves to this method without showing noticeable distortion.

3.5.2.4.5.5.3 Except for diagrams, schematics, orthographic projections, reproduction of approved drawings, all line sketches shall be prepared with the use of shading mediums to clarify and model the form of the sketch. This rendering shall be kept as simple as possible. Fuzzy freehand lines, rendering with fine lines, and cross hatching shall be avoided. Solid black shall be used in dark areas to increase contrast and simplify the sketch. This applies to cutaway views, exploded views and cross-section views.

3.5.2.4.5.6 Color. - Color shall be used functionally where necessary to show electric circuits, the flow of materials, schematic diagrams or operational diagrams. Unessential color shall not be used. Backgrounds of color tints may be used to clarify outline sketches, but color for decoration is not desired.

3.6.2.4.6 Inserting and rehearsing of illustrations.-

3.6.2.4.6.1 Significant features or components of illustrations shall be identified by brief applicable nomenclature with arrows. Index numbers may be used on illustrations with explanatory legend under the sketch or photo only when an extremely large amount of nomenclature is required.

3.6.2.4.6.2 In order to assure a clear definition of lines where they pass through light and dark areas, arrows (leaders) shall be drawn in black with one edge outlined in white. The arrowhead, however, shall be completely outlined in white. The thickness of arrows shall be uniform and no greater than necessary to indicate clearly the desired details.

3.6.2.4.6.3 Index references and letterings (nomenclature) shall be planned to reproduce uniformly a size not less than 10-point type. Where index numbers are used, each illustration shall be handled independently with index numbers assigned consecutively, starting with number 1, except as specified in 3.6.1.8 (b), (c) and 3.6.1.8.2.3.

3.6.2.4.7 Printing.- Printing shall be done by either offset, lithograph or letterpress method, and shall be of equal quality to first-class commercial work. Copy may be type-set, varityped, or type-written with a standard typewriter. In general, type-set copy is preferred with varityped or type copy as second choice. The style of composition to be used, however, shall be governed by the quantity of manuals to be produced, the relative costs of the several methods and the availability of material prepared for earlier manuals. The contractor shall specify the method of composition to be used when manuscripts or sample copies are submitted for approval. The bureau or agency concerned may request data from the contractor to substantiate the method of composition chosen if deemed desirable.

3.6.2.4.7.1 Arrangement.- The text may be arranged in the form of either two vertical columns or a single wide column. The two-column arrangement shown on figures 4 and 7 is preferred; the single column arrangement is shown on figure 8. Right-hand margins shall not necessarily have lines flush at right, but care shall be taken to prepare a generally uniform margin. The size of the page shall be 8-1/2 by 11 inches. Text shall be reproduced on both sides of pages.

3.6.2.5 Paper.- The paper for photolithographic reproduction shall be preferably 25 by 38-60/500-basis White-finish; for letterpress 25 by 38-70/500-basis dull-finish coated stock.

3.6.2.6 Covers.- Covers for manuals less than 1/2 inch thick (less cover) shall be of the bellows fold type and of a black fabricoid material. Covers for manuals over 1/2 inch in thickness shall be made of semifinished board covered with a black fabricoid material, weight 8-1/2 to 9-1/2 ounces per square yard (finished cloth). The covers shall be imprinted in gold, silver or aluminum color with the information shown on figure 1. Backbones of manuals over 1/2 inch in thickness shall be imprinted with the Navy identification (NAVSEIPS) number (see 3.2.1) and title in brief. Covers shall overlap the top, bottom, and right-hand edges of the manual by 3/16 inch. Outside corners of the covers shall be slightly rounded.

3.6.2.7 Binding.- The binding shall be loose-leaf using three 3/16-inch metal posts and screws, spaced on 4-1/4 inch centers. Covers for manuals 1/2 inch thick or more shall have a binding flange of corrosion-resisting metal covered with 700 quality fabricoid. On manuals containing less than 50 pages (25 sheets), split-type metallic fasteners with metallic washers may be used. All metal parts shall be of corrosion-resisting material, or shall be treated to resist corrosion. Should the addition of the parts list (see 3.6.1.9.1) to the manuals result in the final manual containing over 400 pages, the parts list shall be bound in a separate volume with appropriate reference on each volume as to the content of the other volume.

3.6 Type C manuals. -

3.6.1 Contents. - Type C manuals shall contain the following information as applicable, presented in a logical arrangement (see figures 1 to 9, inclusive):

(a) Title page (see figure 2).
(b) General data (see 3.6.1.1).
(c) Table of contents, listing all divisions and primary and secondary subdivisions (such as chapters or sections) with the corresponding page numbers.
(d) List of illustrations and drawings, specifying titles, figure numbers and pages on which such illustrations appear.
(e) Detailed description (see 3.6.1.2).
(f) Installation instructions (see 3.6.1.3).
(g) Adjustments and tests (see 3.6.1.4).
(h) Operating instructions (see 3.6.1.5).
(i) Maintenance (see 3.6.1.6).
(j) Parts identification (see 3.6.1.7).
(k) Drawings (see 3.6.1.8).

Note. - Although these requirements are directly applicable to manuals covering specific equipment, they shall be followed as closely as possible for manuals covering systems, such as engineering piping systems. When a manual covers a system or an equipment composed of several distinct units (for example, a generating set consisting of a Diesel engine, a generator, a voltage regulator, and a controller), it may be desirable to arrange the manual in major divisions, each covering one unit. If so, the major divisions may be arranged by subdivisions, each corresponding to the requirements herein.

3.6.1.1 General data. - This division shall contain data such as the following:

(a) Safety notice (where high voltages or special hazards are involved) (see figure 9).
(b) Component list containing:
  Description of item.
  Navy type designation.
  Standard Navy stock number.
  Dimensions.
  Weight (with or without packing).
(c) Input power requirements and heat dissipation.
(d) Salient design characteristics.
(e) Electron tube complement.
(f) Serial number (if appropriate).

3.6.1.2 Detailed description. - This division shall contain a complete detailed description of component assemblies and accessories which comprise the complete equipment; for example, in the case of a ship's service turbine generator set, the turbine, the gear, the generator, the exciter, and the voltage regulator. Allowable clearances, temperatures or tolerances, shall be shown in tabular form.

3.6.1.3 Installation instructions. - This division shall contain methods of installation, alignment, precautions, mounting instructions, recommendations, regarding shielding, grounding or bonding.

3.6.1.4 Adjustment and tests. - This division shall contain instructions for the adjustment and test of the system and its major components upon initial installation or under other conditions such as after major overhaul where complete system readjustment may be required.

3.6.1.5 Operating instructions. - This division shall contain simple, brief and effective instructions, including normal routines and precautions to be observed in starting, operating, and shutting-down the equipment. Where operations are to be performed in specified sequence, step-by-step procedure shall be used. Operations shall be numbered in the order in which they are to be performed. Operating data which is frequently referred to in operating the equipment shall be included in this division. Tables and charts shall be used for the presentation of these instructions where varying operating conditions are encountered.

3.6.1.6 Maintenance. - This division shall cover all maintenance procedures and routine adjustments which should be performed periodically, as well as instructions for disassembly and replacement of worn or damaged parts. Instructions on lubrication shall be provided as applicable, preferably in chart form, and shall include the type of lubrication recommended by the manufacturer, together with specific time periods. Lubricants shall be described by Military specification numbers, where applicable and by commercial designations. Maintenance instructions shall cover the use of special tools.

3.6.1.7 Parts identification. - This division shall contain identification data covering all repair parts (parts and assemblies which are wearable or expendable during normal repair) to facilitate ready identification of parts for replacement and ordering purposes.

3.6.1.7.1 Parts list. - Parts shall be listed as follows:

(a) Name of part.
(b) Number required.
(c) Actual manufacturer's name and service part number.
(d) Standard Navy Stock Number assigned in accordance with Specification MIL-N-18177.

3.6.1.7.2 Parts illustrations. - A view of each assembly or subassembly or component parts shall be shown. Identification of illustrated parts shall be facilitated by the use of numbers which will identify all the parts in the parts list. Illustrations of the exploded type are preferable. When the use of exploded views is not practical, simple cross-sectional views may be used. The cross-sectional drawings when used for this purpose preferably shall be approved drawings or excerpts from approved drawings, and shall show both the manufacturer's drawing number and the drawing number of the bureau or agency concerned. In case no applicable approved drawing is available, cross-sectional views from manufacturer's drawings may be used.

3.6.1.8 Drawings. - This division shall contain reproductions of approved drawings, additional block diagrams, exploded views or explanatory drawings, as necessary to supplement the descriptive matter contained in the text. Wherever feasible, such diagrams, exploded views and sketches should be inserted in the text as close as possible to that portion of the text to which they apply. Diagrams of switches and relays used in the system showing the terminal numbering shall be inserted as additional drawings. The standard color codes for resistors and capacitors shall be stated, where applicable.

3.6.2 Format. -

3.6.2.1 Divisions (chapters or sections). - Divisions of manuals shall be chapters or sections, numbered or lettered consecutively. In general, chapters shall be the main divisions of larger manuals and sections shall be the main divisions of smaller manuals. Chapters shall be further divided into sections which shall be numbered or lettered consecutively within the chapter. Where chapters are used, the first page of each chapter shall be arranged as shown on figure 2.

3.6.2.2 Page identification and numbering. -

3.6.2.2.1 At the top of each left-hand page, flush with the outside margin, shall appear a briefed title of the manual. At the top of each right-hand page, flush with the outside margin, shall appear the division, chapter or section, number followed by its title. In some cases, it may be necessary to brief the title.

3.6.2.2.2 With the exception of fold-over pages and as otherwise specified herein, pages of the manuals shall be numbered consecutively in the bottom outside corner of each page, using Arabic numerals. The first page of chapter 1 or section 1 shall be page 1. All odd-numbered pages shall appear as right-hand pages. Fold-over pages shall be right-hand pages, and when they are used within the text they shall be assigned two page numbers, and the numbers shall be printed on the face of the sheet. Fold-over pages shall be arranged so that the page numbers are visible without unfolding. Fold-over arrangements are shown on figure 4.

3.6.2.2.2 In manuals arranged for a system or equipment composed of several distinct units (see note under 3.6.1) the pages may be consecutively numbered within each chapter (or section), the first page of each chapter (or section) being page 1. In this case, the page number shall also include the chapter number. The chapter number shall appear first.

3.6.2.3 Layout treatment. - The layout of the manuals shall be such as to conserve space without detracting from the usability or clarity of material presented. Blank pages and spaces shall be avoided wherever possible. Textual material shall be printed on both sides of the page. Illustrations serving no instructional function or to which no reference is made in the text shall not be used. Partial page illustrations within the text are highly desirable. Several small illustrations may be grouped to form a single page layout. Wherever possible, illustrations shall be located so that reference can be made from applicable text without turning a page. Fold-over pages, double, or triple pages will be permitted only for illustrations where this procedure is essential to insure legibility. Fold-over pages shall be used primarily in the back of the manual for the purpose of reproducing the drawings. Whenever it is desirable to include fold-over pages with the text in the front of the manual, such fold-over pages shall not be backed up with text or illustrations. All drawings which will be used for reference purposes while reading the text shall be provided with a blank section of the same size as a page at the left-hand edge of the drawing (see figure 8). This will permit the drawing to be withdrawn clear of the manual while the text is being studied. Drawings shall be reproduced on a page the same height as other pages in the manual, in order that all folds will be parallel to the bound edge of the manual.

3.6.2.4 Text. -

3.6.2.4.1 Tables and charts. - The use of tables and charts is desirable. Such tables and charts shall not be elaborate or complicated, and sufficient explanation shall be given to make them easily understood.

3.6.2.4.2 References to figures. - Where reference is made to figures, the reference shall be to the figure number. The page number shall not be used except when the illustration is located more than three pages away from the reference. When reference is made to items shown on figures by index numbers, figure number and index number shall be indicated as follows: "Remove nut (7) and drive out bolt (8) (see figure 20).

3.6.2.4.3 Numbers. - Numbers from one to nine, inclusive, appearing in the text for the purpose of stating quantities shall be spelled out. All other numbers shall be shown as numerals except when they are used at the beginning of a sentence, in which case they shall be spelled out and followed by the numeral in parentheses.

3.6.2.4.4 References to materials. - All materials required for maintenance referred to in the manual, such as lubricants, sealing materials or abrasives, shall be described by Military specification numbers where applicable.

3.6.2.4.5 Illustrations. - Illustrations (including photographs, exploded views, drawings and sketches) shall be well planned and executed. They shall enable immediate and thorough comprehension of the subject.

3.6.2.4.5.1 Illustration identification. - Illustrations shall be identified by figure number and a title. Identifying figure numbers and titles shall be positioned immediately beneath the illustration. Whenever reduced size reproductions of drawings are used as illustrations, the drawing number shall be shown as well as the figure number.

3.6.2.4.5.2 Photographs. - Photographic illustrations shall be prepared with equipment capable of reproducing all details and shall show clearly the subject matter. Photographs shall be uniformly retouched to define shapes, accentuate details, and establish correct tone value of sufficient contrast for photolithographic reproduction.

3.6.2.4.5.3 Exploded views. - Exploded views may be used for showing the component parts of a subject. Well retouched photographs in which sharp contrast is incorporated to insure distinct detailed separation of parts may also be used for this purpose. It is preferable that all parts be exploded on their functional axis.

3.6.2.4.5.4 Drawings. - When drawings are necessary to illustrate the description, operation, and maintenance of the equipment or system, they shall be reduced in size as necessary (see figure 5), and reproduced in black and white. Each drawing shall be identified with the drawing number of the manufacturer and the bureau or agency concerned. Drawings shall be bound into the manual as shown on figure 5 (see also 3.6.2.3). Drawings shall normally be placed in the back of the manual but they may be inserted close to the references when practicable. Care shall be taken in the preparation of drawings for reproduction in the manual to insure that when the drawings are reduced in size they shall be clear and legible.

3.6.2.4.5.5 Sketches (see figure 6). - (NOTE: This paragraph does not pertain to reduced-size reproduction of standard approved drawings nor to portions of these drawings which may be extracted and used as illustrations in a manual.)

3.6.2.4.5.5.1 The rendering of sketches (airbrushing or line rendering) shall be done with the highest possible contrast. Adjoining areas of an illustration having similar values are to be avoided. Edges of all silhouette half-tone illustrations shall be sharply defined by retouching.

3.6.2.4.5.5.2 Exploded views and cutaway views shall be drawn in perspective to appear as realistic as possible without distortion. Isometric views may be used for small parts or units which lend themselves to this method without showing noticeable distortion.

3.6.2.4.5.5.3 Except for diagrams, schematics, orthographic projections, reproductions of approved drawings, all line sketches shall be prepared with the use of shading mediums to clarify and model the form of the sketch. This rendering shall be kept as simple as possible. Fuzzy freehand lines, rendering with fine lines, and cross hatching shall be avoided. Solid black shall be used in dark areas to increase contrast and simplify the sketch. This applies to cutaway views, exploded views and cross-section views.

3.6.2.4.6 Indexing and referencing of illustrations. -

3.6.2.4.6.1 Significant features or components of illustrations shall be identified by brief applicable nomenclature with arrows. Index numbers may be used on illustrations with explanatory legend under the sketch or photo only when an extremely large amount of nomenclature is required.

3.6.2.4.6.2 In order to insure a clear definition of lines where they pass through light and dark areas, arrows (leaders) shall be drawn in black with one edge outlined in white. The arrowhead, however, shall be completely outlined in white. The thickness of arrows shall be uniform and no greater than necessary to indicate clearly the desired details.

3.6.2.4.6.3 Index references and letterings (nomenclature) shall be planned to reproduce uniformly at size not less than 10-point type. Where index numbers are used, each illustration shall be handled independently with index numbers assigned consecutively, starting with number 1.

3.6.2.4.7 Printing. - Printing shall be done by either offset, lithograph or letterpress method, and shall be of equal quality to first-class commercial work. Copy may be type-set, varityped, or typewritten with a standard typewriter. In general, type-set copy is preferred with varityped or type copy as second choice. The style of composition to be used, however, shall be governed by the quantity of manuals to be produced, the relative costs of the several methods, the availability of material prepared for earlier manuals. The contractor shall specify the method of composition to be used when manuscripts or sample copies are submitted for approval. The bureau or agency concerned may request data from the contractor to substantiate the method of composition chosen if deemed desirable.

3.6.2.4.7.1 Arrangement. - The text may be arranged in the form of either two vertical columns or a single wide column. The two-column arrangement shown on figures 4 and 7 is preferred; the single column arrangement is shown on figure 8. Right-hand margins shall not necessarily have lines flush at right, but care shall be taken to prepare a generally uniform margin. The size of the page shall be 8-1/2 by 11 inches. Text shall be reproduced on both sides of paper.

3.6.2.6 Paper. - The paper for photolithographic reproduction shall be preferably 25 by 38-40/500-basis lithe-finish; for letterpress 25 by 38-70/500-basis dull-finish enamel stock.

3.6.2.6 Covers. - Covers for manuals less than 1/2 inch thick (less cover) shall be of the buckram fold type and of a black fabricoid material. Covers for manuals over 1/2 inch in thickness shall be made of semiflexible board covered with a black fabricoid material, weight 6-1/2 to 7-1/2 ounces per square yard (finished cloth). The covers shall be imprinted in gold, silver or aluminum color with the information shown on figure 1. Backbones of manuals over 1/2 inch in thickness shall be imprinted with the Navy identification (NAVSHIPS) number (see 3.2.1) and title in brief. Covers shall overlap the top, bottom, and right-hand edges of the manual by 3/16 inch. Outside corners of covers shall be slightly rounded.

3.6.2.7 Binding. - The binding shall be loosleaf using three 3/16-inch metal posts and screws spaced on 4-1/4 inch centers. Covers for manuals 1/2 inch thick or more shall have a binding flange of corrosion-resisting metal covered with 700 quality fabricoid. On manuals containing less than 50 pages (25 sheets), split-type metallic fasteners with metallic washers may be used. All metal parts shall be of corrosion-resisting material, or shall be treated to resist corrosion. Should the addition of the parts list (see 3.6.1.7.1) to the manual result in the final manual containing over 400 pages, the parts list shall be bound in a separate volume with appropriate reference on each volume as to the content of the other volumes.

3.7 Type D manuals. -

3.7.1 Contents. - Type D manuals shall consist of manufacturer's standard commercial instructions and parts lists bound together.

3.7.2 Format. -

3.7.2.1 Covers. - Covers shall be of a dark color fabricoid material. The cover shall show name and model of the equipment, manufacturer's name and address, Navy contract or order number and Navy NAVSHIPS identification number. Printing shall be of a light contrasting color. Covers shall be 8-1/2 by 11 inches for all manuals of that size or smaller (see figure 1).

3.7.2.2 Binding. - The manuals and covers shall be bound either by stapling, stitching or by use of metal binding posts.

3.8 Workmanship. - The workmanship shall be of high quality comparable in text compilation, arrangement, and accuracy to high-grade commercial manuals and parts catalogs. Copy which has filled letters or is blurred will not be acceptable. The workmanship shall be satisfactory to the bureau or agency concerned.

4. QUALITY ASSURANCE PROVISIONS

4.1 The methods of approval are specified in section 3.

4.2 Inspection procedures. - For naval purchases, the general inspection procedures shall be in accordance with General Specifications for Inspection of Material.

5. PREPARATION FOR DELIVERY

5.1 Packaging for domestic and overseas shipment. -

5.1.1 All manuals shall be packaged individually consistent with good commercial practice so as to ensure that they are kept dry and clean.

5.2 Packing.-

5.2.1 Equipment manuals for domestic and overseas shipment.- Two copies of the manual shall be packed within the shipping container holding the main unit of equipment.

5.2.2 Spare manuals.-

5.2.2.1 For domestic shipment.- Manuals packaged as specified in 5.1.1 shall be packed in shipping containers suitable to method of shipment used and in conformance with good commercial practice. The gross weight of the container shall not exceed 200 pounds.

5.2.2.2 For overseas shipment.- Manuals packaged as specified in 5.1.1 shall be packed in shipping containers which are so lined as to preserve the manuals from water damage and dampness in conformance with good commercial practice. The shipping containers shall be so closed or strapped as to give additional strength necessary to prevent collapsing during shipment. The gross weight of wood boxes shall not exceed 140 pounds; of fiberboard boxes, 70 pounds.

6. NOTES

6.1 Ordering data.-

6.1.1 Procurement documents should specify the following:

(a) Title, number, and date of this specification.
(b) Type required (see 1.2).
(c) Quantity of manuals required (see 2.2).
(d) Requirements for type A (see 3.3).
(e) Details of special requirements for drawings, charts and illustrations, pertinent to the particular equipment, if not covered by the equipment specification.
(f) Security classification, if required (see 3.4.4).
(g) Whether the manuals are to be packed and marked for domestic or overseas shipment (see 5.1 and 5.2).

6.2 Figures 1 through 16 inclusive have been marked "CONFIDENTIAL" for demonstration purposes only.

Patent notice.- When Government drawings, specifications, or other data are used for any purpose other than in connection with a definitely related Government procurement operation, the United States Government thereby incurs no responsibility nor any obligation whatsoever; and the fact that the Government may have formulated, furnished, or in any way supplied the said drawings, specifications, or other data is not to be regarded by implication or otherwise as in any manner licensing the holder or any other person or corporation, or conveying any rights or permission to manufacture, use, or sell any patented invention that may in any way be related thereto.

Custodian:
Bureau of Ships

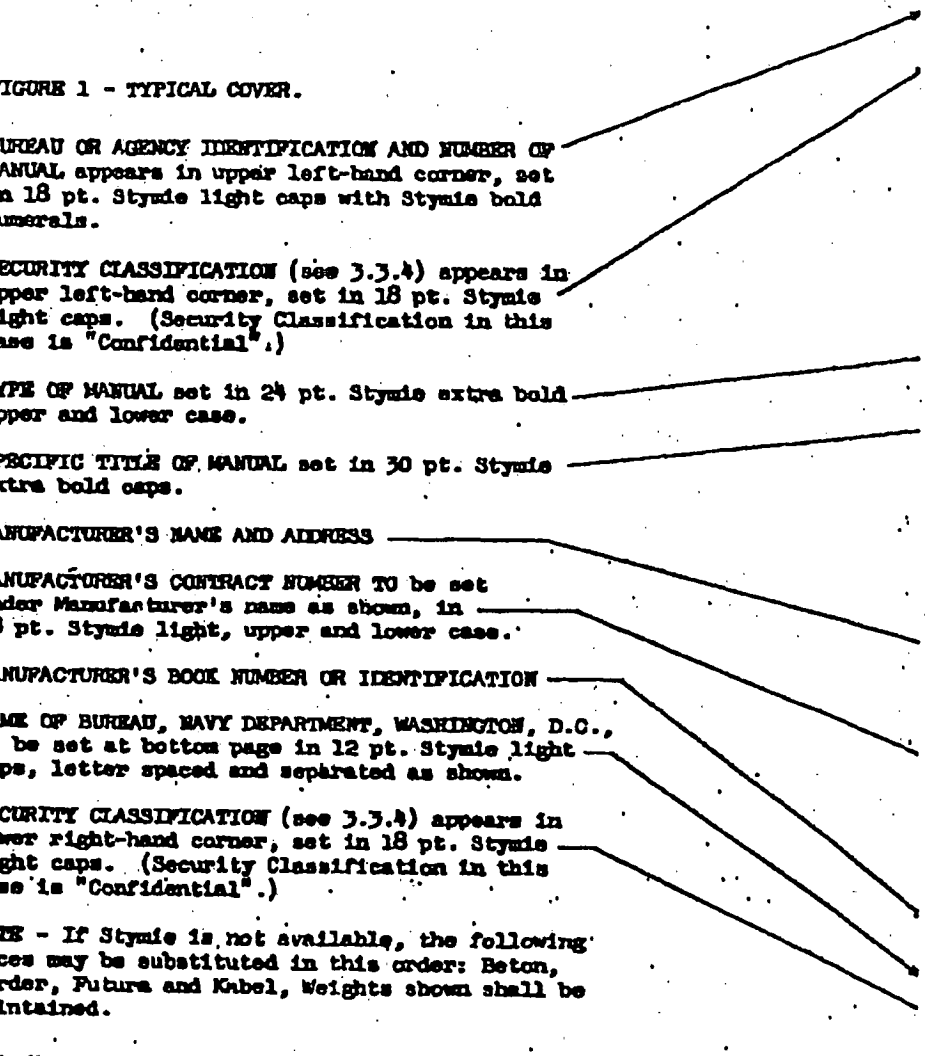


FIGURE 1 - TYPICAL COVER.

NOTE - If Stymie is not available, the following faces may be substituted in this order: Beton, Girder, Futura and Kabel. Weights shown shall be maintained.

(This figure is marked Confidential for demonstration purposes only.)

NAVSHIPS 000-0000

CONFIDENTIAL

TECHNICAL MANUAL

450-KW AC/DC GENERATOR SET STEAM-TURBINE

MANUFACTURER'S NAME, AND ADDRESS

Contract NObs-0000

MANUFACTURER'S BOOK NUMBER

BUREAU OF SHIPS - NAVY DEPARTMENT - WASHINGTON, D.C.

CONFIDENTIAL

FIGURE 2 - TYPICAL TITLE PAGE.

SECURITY CLASSIFICATION (see 3.3.4) appears in upper right-hand corner set in 18 pt. Stymie light caps. (Security classification in this case is "Confidential".)

BUREAU OR AGENCY IDENTIFICATION AND NUMBER OF MANUAL appears in upper right corner, set in 18 pt. Stymie light caps with Stymie bold numerals.

TYPE OF MANUAL set in 24 pt. Stymie extra bold upper and lower case.

SPECIFIC TITLE OF MANUAL set in 30 pt. Stymie extra bold caps.

APPLICABLE VESSELS (when appropriate) to be set under title of manual, as shown, in 18 pt. Stymie light, upper and lower case. "WARNING" paragraph shall be set 8 pt. Stymie bold, upper and lower case (see 3.3.4).

MANUFACTURER'S NAME AND ADDRESS

MANUFACTURER'S CONTRACT NUMBER to be set under Manufacturer's Name and address as shown in 18 pt. Stymie light, upper and lower case.

MANUFACTURER'S BOOK NUMBER OR IDENTIFICATION

DATE OF MANUAL to be included at the lower right of page.

SECURITY CLASSIFICATION (see 3.3.4) appears in lower right-hand corner, set in 18 pt. Stymie light caps with Stymie bold numerals.

(This figure is marked Confidential for demonstration purposes only.)

CONFIDENTIAL
NAVSHIPS 000-0000

TECHNICAL MANUAL

450-KW AC/DC GENERATOR SET STEAM-TURBINE

C1-55 CLASS

WARNING: This document contains information affecting the national defense of the United States within the meaning of the Espionage Laws, Title 18, U.S.C., Sections 793 and 794. The transmission or the revelation of its contents in any manner to an unauthorized person is prohibited by law.

MANUFACTURER'S NAME, AND ADDRESS

Contract NObs-0000

MANUFACTURER'S BOOK NUMBER

BUREAU OF SHIPS - NAVY DEPARTMENT - NOVEMBER 1952

CONFIDENTIAL

FIGURE 3 - TYPICAL CONTENTS PAGE

SECURITY CLASSIFICATION (see 3.3.4) appears in upper right-hand corner set in 12 pt. Futura bold caps. (Security Classification in this case is "Confidential".)

CHAPTER TITLE to appear in upper right-hand corner set in 18 pt. Futura bold caps.

CHAPTER AND NUMBER to be set in 30 pt. Stymie light, upper and lower case.

"DETAILED DESCRIPTION" to be set in 14 pt. Stymie light caps.

"LIST OF SECTIONS" and "PAGE NO." to be set in 10 pt. Stymie light caps.

THE LISTING OF SECTIONS (number, name, and page) to be set in 14 pt. Futura bold, upper and lower case. All of the above materials is to be set as close as possible in style to that shown with sufficient leading and with the whole text block centered between the rules.

FOLIO NUMBER to appear on trim edge and bottom and to be set in 12 pt. Futura bold.

SECURITY CLASSIFICATION to appear on right-hand side at the bottom and to be set in 12 pt. Futura bold caps.

NOTE.- Girder or Beton light or medium may be substituted for Stymie. Any other Sans Serif type of same weight may be substituted for Futura.

(This figure is marked Confidential for demonstration purposes only.)

CONFIDENTIAL
DETAILED DESCRIPTION

Chapter 2
DETAILED DESCRIPTION

CONFIDENTIAL

CONFIDENTIAL

Title of manual – upper corner left-hand pages
14 pt. Future medium caps.

450 - KW AC/DC GENERATOR SET, STEAM-TURBINE

SECTION 1 — 18 pt. Stymie medium caps.

1 pica — 18 pt. Stymie medium upper and lower case.

Description of Turbine (Give complete name plate data as part of the title of description of turbine, reduction, etc.)

3 picas

The general arrangement of the set is shown in Fig. 4. The turbine and pinion shafts are rigidly connected and supported by three bearings, one in the reduction-gear casing and one at the exhaust end of the turbine.

Primary Subheads—14 pt. Future extra bold caps centered. ROTOR

The bucket wheels, shaft, coupling flange, and balancing rings are all integral, being machined from a solid alloy steel forging. The pinion is keyed on over end of the turbine rotor and the emergency governor on the other. The overall complete with buckets, is balanced statically and dynamically at the factory.

1 pica

Subspacing Rings

2 pt. spaced

The coupling flange of the rotor is tapped on its outer periphery for radial balancing plugs. See photograph below. At the exhaust end, the shaft carries another integrally forged balancing ring, tapped for radial balancing plugs.

DYNAMIC BALANCING. Adjustment of the rotor for dynamic balance is accomplished by the insertion at the proper points in these rings of balancing plugs of the correct weight. The plugs, when threaded into their holes, are drawn flush with the outer shoulder, and the outer thread of the hole is staked over. See Fig. 31, page 34, for generator balancing rings.

All of the holes are filled initially with one-half inch screw plugs to minimize windage loss, and the balancing plugs are substituted where necessary. These plugs provide an accessible means of balancing when subassembling the rotor. During inspection periods it is advisable to inspect all plugs to see that they are tight.

Buckets

The buckets on all the wheels are of corrosion-resisting steel, and are attached by T-head dovetails. The buckets are spaced by shims at the dovetail, machined as an integral part. The buckets are banded together in sections by steel shrunk bands around outer the buckets.

FIGURE 4. TYPICAL TEXT PAGE

A typical text page spread is shown here with type and spacing specifications noted. New sections may be started near the bottom of the page if the space allows a minimum of three lines of type in each column; tabulated matter may be run two columns or one column.

Fig. 4.– Turbo-generator set as seen from turbine end, throttle-valve side

Classification—Inner bottom corner, 18 pt. Future bold caps.

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Plus

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Chapter Heading—upper right-hand corner of right-hand pages, 14 pt. Future uniform caps. DETAILED DESCRIPTION

1 pt. rule 1 pica

A shrunk band of corrosion-resisting steel extends completely around the outer circumference of the buckets on each wheel. This band closes over the tops of the buckets and, by projecting slightly on each side of the buckets, aids in preventing steam leakage over the tops of the wheels.

The low-pressure end of the rotor rests on anti-gravity governor assembly. The bearing of the assembly is machined to receive a conical wrench for loosening the cone by hand. A wrench for this purpose is furnished with the units.

NOZZLE PLATE

The cast steel ten-stage nozzle plate (3), Fig. 2, is bolted to and rolled in the upper half of the high-pressure head. The nozzle plate contains a series of curved nozzle opening into pockets on the high-pressure side.

Nozzle Diaphragms

The five nozzle diaphragms are made of steel with welded expansion-relief and nozzle positions.

Secondary Subhead—14 pt. Future extra bold upper and lower case. Flush left. Mounting

Because of the high steam temperatures at the inlet end of the casing, the second-stage diaphragm is supported at the center line to allow for radial expansion.

Second-Stage Diaphragm. The lower half of the second-stage diaphragm is further positioned by the centering dowel (7) in the bottom of the casing. Guide pins (4) around the periphery of the diaphragm assist in holding both halves securely in place.

84 picas

SECTION 2

Description of Speed Reducing Gear

2 picas

The reducing gear is the single-reduction, single-helical type, and reduces the turbine speed of 10,000 r. p. m. to the governor speed of 4,200 r. p. m.

PINION

The pinion is forged integral with the shaft. One end of the shaft is provided with a flange that bolts rigidly to the turbine shaft and through which one end of the turbine rotor is supported. The other end of the pinion shaft has an extension, on which is assembled the thrust bearing. The complete assembly is shown in Fig. 6.

GEAR WHEEL

The gear wheel is a steel forging and is pressed and keyed on a forged steel shaft. One end of the gear shaft is solidly coupled to the governor shaft, and part of the weight of the governor rotor is carried by the gear bearing at that end. The turbine end of this shaft is extended to carry the spiral gear that drives the oil pump and the governor.

GEAR CASING

The gear casing consists of two halves which are joined at the horizontal center line of the rotor. The bearing seats for supporting the gear and pinion bearings, the oil pump casing, and the supports for the high-pressure end of the turbine are fabricated integral with the lower half of the casing.

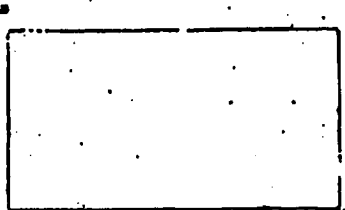

Fig. 5—View of the pinion showing half of the shaft coupling, which is bolted to the turbine rotor

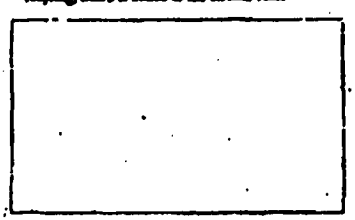

Fig. 6—Reducing gear with upper half casing removed showing the pinion and gear wheel assembled in their operating position. Captions—Italic of text.

Folio—Outer bottom corner, 12 pt.

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(This figure is marked Confidential for demonstration purposes only.)

CONFIDENTIAL

MODEL GSB-6 DIESEL ENGINE

FIGURE 5. TYPICAL GATEFOLD OR FOLD-IN PAGES

The following two pages illustrate correct style that may be followed in gatefold pages where oversize illustrations of blueprints are to be used. Fold-over pages, double, or triple pages will be permitted only for illustrations where essential to insure legibility.

ENGINE THROTTLE CONTROL

DESCRIPTION

The engine throttle control system is made up of a series of linkages which, in direct connection with a hydraulic system, enable the operator to start and operate the engine at any required speed. (Fig. 5.) For complete understanding the following description is essential:

1. A mechanical linkage sets the limit at which fuel can be injected.
2. The engine throttle control sets the operating fuel pressure of the fuel pump.
3. A mechanical linkage from the control governor operates the control shaft which is coupled to the fuel injectors.
4. The hydraulic system, in conjunction with the linkage system, operates the control governor regulator shaft.
5. The throttle control operates the limit switch which controls the electrical circuit of the brake on the propeller shaft, just aft of the reduction gear.

The engine throttle control system is actuated by the movement of the throttle lever, or handle, of the hydraulic transmitter, which is located on the other side of the engine control box. (Fig. 1.) When the throttle lever is in the extreme rear position, the hydraulic transmitter and receiver units are synchronized. (This function will be explained in detail later in this section.)

As the throttle handle is moved forward, beyond the synchronizing range, it reaches the point where, for a few degrees of travel, it operates the air starting system (Section 20). When the air starting system is functioning, no fuel is admitted into the cylinders, however, at the instant when the throttle handle is moved further forward and the air starting valve is released, fuel oil is then injected into the cylinders, and the engine begins to operate under its own power. Continuing the forward movement of the throttle handle increases the amount of fuel oil which is injected into the cylinders, and thereby increases the speed and power of the engine (Section 4).

The control shaft of the transmitter is linked with the throttle shaft which, in turn, is directly linked with the throttle lever cube. The throttle shaft is supported in two bronze bearings which are bolted to pads on the cylinder block, just below the camshaft trough. (Fig. 3.)

The throttle lever cube floats on the control shaft, and a lever attached to it is connected with the regulating adjusting lever of the fuel oil pump. A spring loaded piston and cylinder assembly is built into the regulating adjusting lever, and its function is to permit the throttle shaft to pass through the synchronizing and air starting stages without moving the fuel pump pressure regulating lever. This permits the regulating lever to be moved from its idling position to maximum engine load position. A pin lever, welded on the throttle lever cube, sets a position beyond which the control lever on the control shaft cannot advance. Therefore, the control lever cannot be advanced beyond the throttle setting, and no additional fuel oil will be injected into the cylinders until the throttle is advanced further. The control lever rides on the pin lever of the throttle lever cube, unless the automatic function of the governor tends to hold it away from the pin lever.

The two fuel injectors are synchronized and are coupled by the intermediate control shaft. The other fuel injector is coupled to the control shaft, which is supported at the opposite end by a ball bearing in a bracket attached to the camshaft gear cover.

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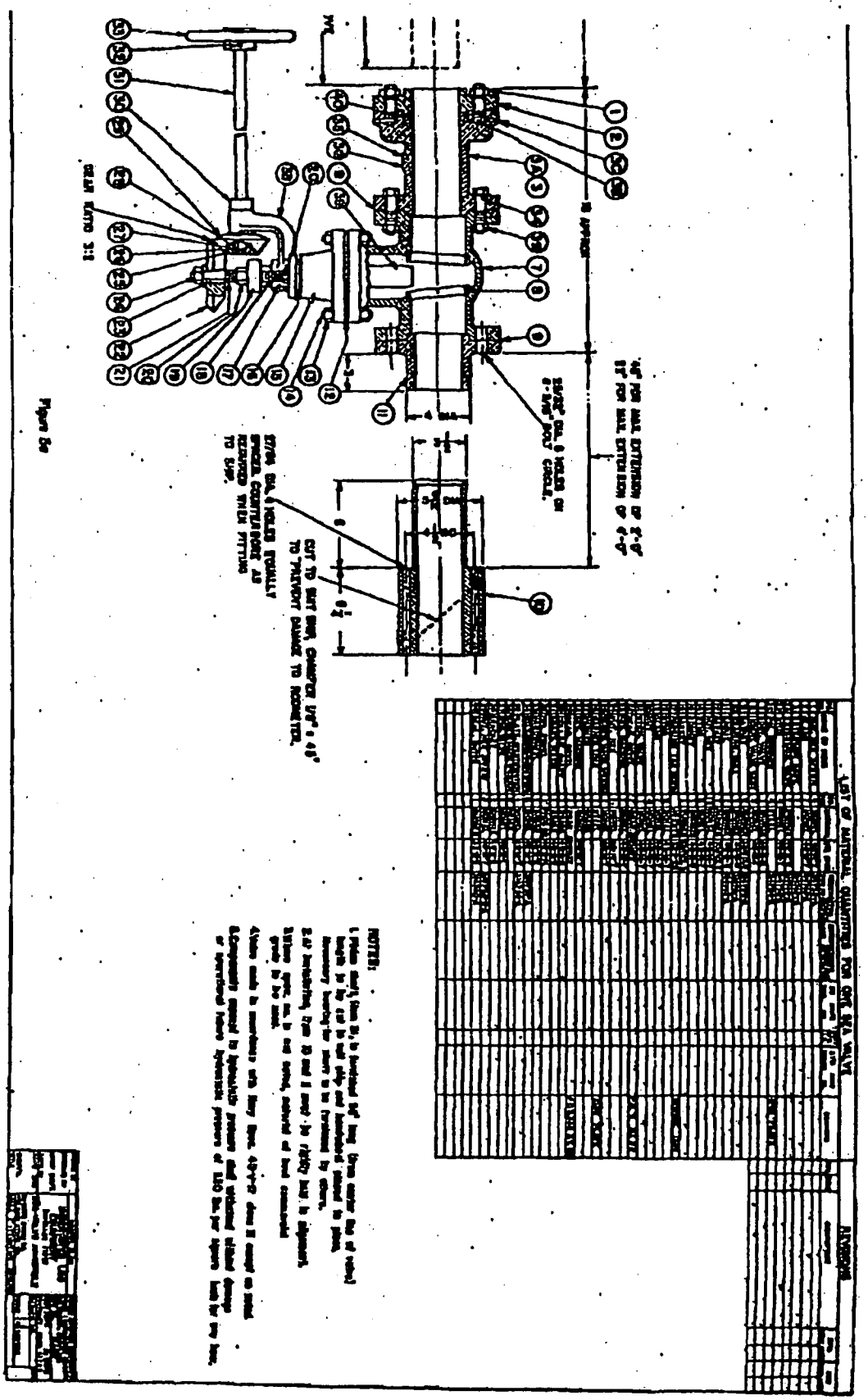
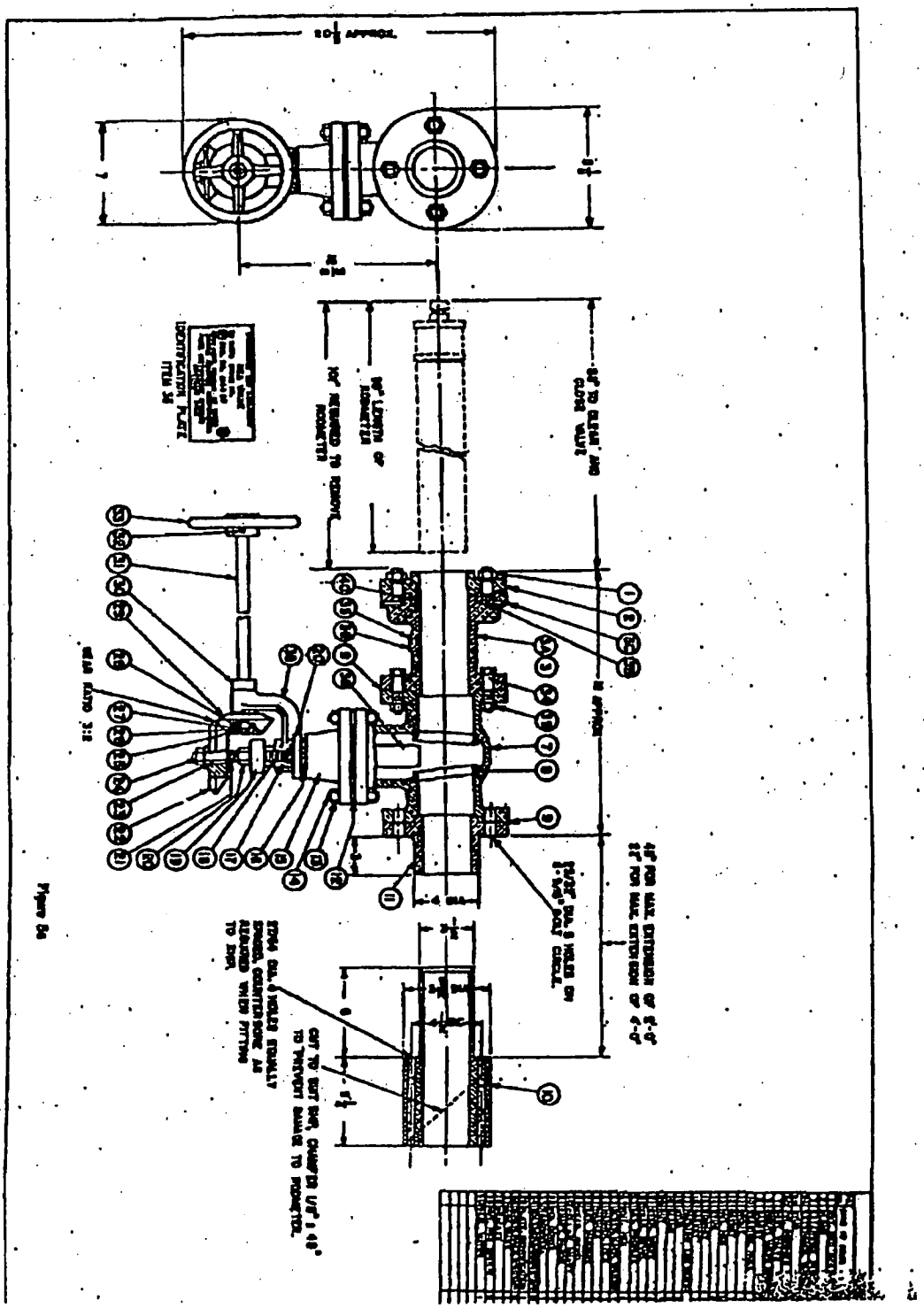
(This figure is marked Confidential for demonstration purposes only.)





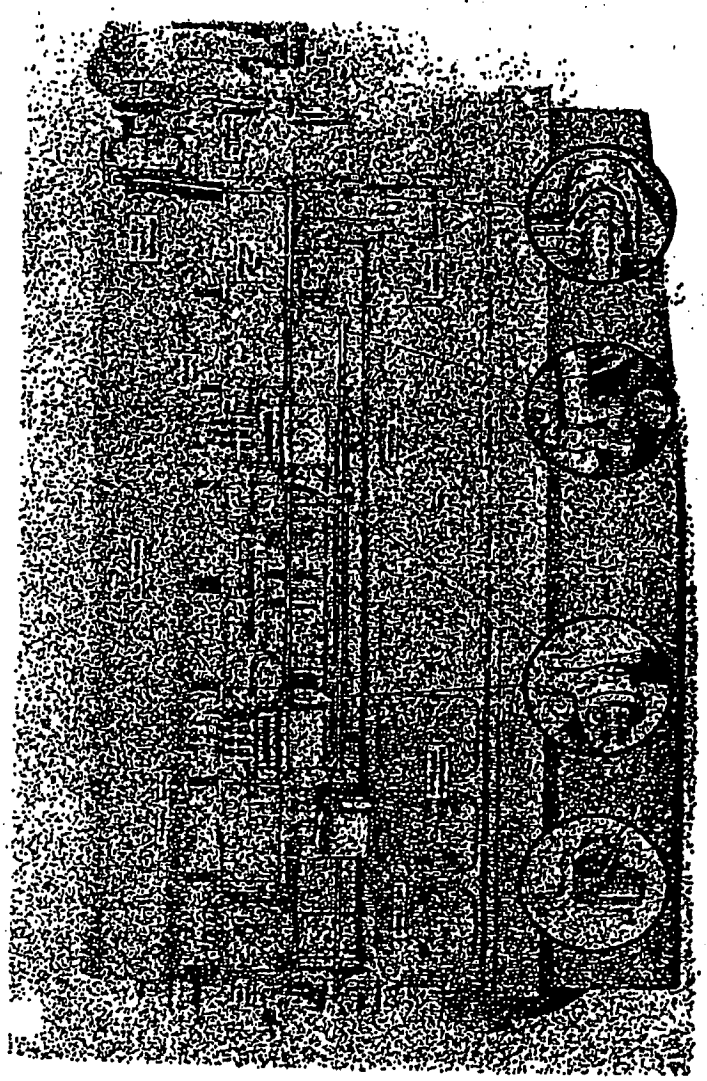


Figure 6b. - Engine Control System.
(This figure is marked confidential for demonstration purposes only.)

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FIGURES 7 AND 8

These figures show approved style to be followed on manuals which are to be typewritten, varityped, or set with the electronatic typewriter. All copy should be prepared to allow for a 15- or 20-percent reduction in size.

TITLE OF MANUAL MFR'S NUMBER

PART I

DESCRIPTION OF TURBINE AND GEAR

GENERAL ARRANGEMENT

The design of the turbine and arrangement of the main parts are shown in the assembly drawing, Fig. 2. The turbine, as well as the gear and generator, is mounted on a rigid steel base as indicated in the outline, Fig. 1. The exhaust end of the turbine is carried from the base on vertical supports which are rigid in a cross-axis direction but are flexible in an axial direction thereby allowing for axial expansion of the turbine casing under load conditions. The high-pressure end of the turbine is bolted rigidly to the gear casing.

SECTION I

DESCRIPTION OF TURBINE

The throttle valve is provided with both a hand-wheel for manual control and an emergency tripping device. The throttle valve will be tripped closed automatically by an emergency governor.

ROTOR AND BUCKETS

The turbine rotor (1), Fig. 3, consisting of shaft, bucket wheels, and coupling, is machined from a solid steel forging. The coupling flange of the rotor is tapped around its outer periphery for balancing plugs.

The throttle valve is provided with a hand-wheel for manual control and an emergency tripping device. The throttle valve will be tripped closed automatically by an emergency governor.

Buckets

The buckets of all six wheels are made of corrosion-resisting steel. They are secured to the periphery of each wheel by dovetails. The spacing of the buckets around the wheels is determined by shims at the dovetails. The shims form a part of the buckets.

A shroud-band of corrosion-resisting steel extends completely around the outer circumference of the buckets on each wheel. This band closes over the tops of the buckets and, by projecting slightly on each side of the buckets, aids in preventing steam leakage over the tops of the wheels.

The low-pressure end of the rotor carries an emergency governor assembly. The bearing of the assembly is backed to receive a ratchet wrench for turning the rotor by hand. A wrench for this purpose is furnished with the units.

NOZZLE PLATE

The cast steel first-stage nozzle plate (3), Fig. 2, is bolted to and caulked in the upper half of the high pressure head. The nozzle plate contains a series of tapped nozzles opening into ports on the high-pressure side.

NOZZLE DIAPHRAGMS

The [illegible] nozzle diaphragms are made of steel [illegible] corrosion-resisting steel nozzle partitions. [illegible] the diagram five nozzle diaphragms of steel with welded corrosion-resisting steel nozzle partitions.

Packing

Because of the high steam temperature at the inlet end of the casing, the second-stage diaphragm is supported at the centerline to allow for radial expansion.

SECOND STAGE DIAPHRAGM: The lower half of the second stage diaphragm is further positioned by the centering dowel (7) in the bottom of the casing. Cross pins (8) around the periphery of the diaphragm assist in holding both halves securely in place.

LOCATION OF DIAPHRAGMS: The other four diaphragms, which are located in the pinkest casing are mounted as shown in Fig. 3b. The cast steel first-stage nozzle plate (3), Fig. 3 is bolted to and caulked in the upper half of the high pressure head.

The first stage is drained through a valve at the bottom of the casing.

TURBINE CASING

The turbine casing consists of a steel high-pressure head (4), Fig. 2, and a steel exhaust casing.

Figure 7.

MFR'S NUMBER TITLE OF MANUAL

PART I

DESCRIPTION OF TURBINE AND GEAR

GENERAL ARRANGEMENT

The design of the turbine and arrangement of the main parts are shown in the assembly drawing, Fig. 2. The turbine, as well as the gear and generator, is mounted on a rigid steel base as indicated in the outline, Fig. 1. The exhaust end of the turbine is carried from the base on vertical supports which are rigid in a cross-axis direction but are flexible in an axial direction thereby allowing for axial expansion of the turbine casing under load conditions. The high-pressure end of the turbine is bolted rigidly to the gear casing.

SECTION I

DESCRIPTION OF TURBINE

The throttle valve is provided with both a handwheel for manual control and an emergency tripping device. The throttle valve will be tripped closed automatically by an emergency governor.

Rotor and Buckets

The turbine rotor (1), Fig. 2, consisting of [illegible] ele, and coupling, is machined from a solid steel forging. The coupl[illegible] is tapped around its outer periphery for balancing plugs.

The throttle valve is provid[illegible] el for manual control and an emergency tripping device. The throttle [illegible] closed automatically by an emergency governor.

Buckets

The buckets of all six wheels are made of corrosion-resisting steel. They are secured to the periphery of each wheel by dovetails. The spacing of the buckets around the wheels is determined by skirts at the dovetails. The skirts form a part of the buckets.

A shroud-band of corrosion-resisting steel extends completely around the outer circumference of the buckets on each wheel. This band closes over the tops of the buckets and, by projecting slightly on each side of the buckets, aids in preventing steam leakage over the tops of the wheels.

The low-pressure end of the rotor carries an emergency governor assembly. The housing of the assembly is machined to receive a ratchet wrench for turning the rotor by hand. A wrench for this purpose is furnished with the units.

Nozzle Plate

The cast steel first-stage nozzle plate (3), Fig. 2, is bolted to and sealed in the upper half of the high pressure head. The nozzle plate contains a series of reamed nozzles opening into ports on the high-pressure side.

Nozzle Diaphragms

The five nozzle diaphragms are made of steel with welded corrosion-resisting steel nozzle partitions. All of the diagrams five nozzle diaphragms are made of steel with welded corrosion-resisting steel nozzle partitions.

Mounting

Because of the high steam temperature at the inlet end of the casing, the second-stage diaphragm is supported at the centerline to allow for radial expansion.

Figure 8.

FIGURE 9 - WARNING

Voltages over 300 volts shall be measured as follows:

(1) Deenergize the equipment. Ground terminals to be measured to discharge any capacitors connected to these terminals. (see Note F).

(2) Connect meter to terminals to be measured using a range higher than the expected voltage.

(3) WITHOUT TOUCHING METER OR TEST LEADS, energize the equipment and read the meter.

(4) Deenergize the equipment. Ground the terminals connected to the meter before disconnecting meter.

NOTES:

(A) MAKE SURE YOU ARE NOT GROUNDED whenever you are adjusting equipment or using measuring equipment.

(B) In general, USE ONE HAND ONLY when servicing live equipment.

(C) If test meter must be held or adjusted while voltage is applied, GROUND the case of the meter before starting measurement and DO NOT touch the live equipment or personnel working on live equipment while you are holding the meter. Some moving vane type meters should not be grounded. These should not be held during measurements.

(D) DO NOT FORGET that high voltages MAY BE PRESENT across terminals that are normally low voltage, due to equipment breakdown. Be careful even when measuring low voltages.

(E) DO NOT use test equipment known to be in poor condition.

(F) High voltage high capacity capacitors should be discharged with a grounding stick with approximately 10 ohms in series with the grounded line. Where neither terminal of a capacitor is grounded. Short capacitor is grounded, short capacitor terminals to each other.

Exhibit D

TO THE AFFIDAVIT OF ADMIRAL HORNE

ADVANCE COPY

MIL-M-15071D(SHIPS)
6 June 1961
SUPERSEDING
MIL-M-15071C(SHIPS)
10 September 1957

MILITARY SPECIFICATION

MANUAL, SERVICE (INSTRUCTION BOOKS) FOR SHIPBOARD ELECTRICAL AND MECHANICAL EQUIPMENT

1. SCOPE

1.1 Scope. - This specification sets forth Bureau of Ships requirements for classes and general contents of manuals necessary for the satisfactory operation, maintenance, installation, overhaul and repair, without the services of manufacturer's representative, of electrical, mechanical, hull, interior communication and fire control shipboard equipment. This specification also includes procedures for submission, review, approval and revision of the service manual. The intent is to accept the manufacturer's commercial type of manual or one prepared in accordance with his commercial practice whenever it is roughly equivalent to the detail requirements included herein.

1.2 Classification. - Service manuals shall be of the following classes:

Class A manual - A basic manual covering a family of equipment of the same basic design and one which can be made applicable to a specific equipment manufactured to that basic design by completing sheets and blanks.
Class B manual - A manual covering a specific equipment for which a class A approval has not been obtained.

2. APPLICABLE DOCUMENTS

2.1 The following documents, of the issue in effect on date of invitation for bids, form a part of this specification to the extent specified herein.

SPECIFICATIONS

MILITARY

MIL-D-963 - Drawing, Electrical, Hull and Mechanical Equipment for Naval Shipboard Use.

FSC 7610

PUBLICATIONS

DEPARTMENT OF DEFENSE

DD Form 441 (Attachment) - Industrial Security Manual for Safe-guarding Classified Information.

(Copies of specifications and publications required by contractors in connection with specific procurement functions should be obtained from the procuring activity or as directed by the contracting officer.)

2.2 The following document forms a part of this specification to the extent specified herein. Unless otherwise indicated, the issue in effect on date of invitation for bids shall apply.

OFFICIAL CLASSIFICATION COMMITTEE

Uniform Freight Classification Rules.

(Application for copies should be addressed to the Official Classification Committee, 1 Park Avenue at 33rd Street, New York 16, N. Y.)

3. REQUIREMENTS

3.1 Media for final manuals and approval. -

3.1.1 Class A manuals. - Whenever a manufacturer's equipment lends itself to the preparation of a manual covering a family of equipments of the same basic design and one which can be made applicable to specific equipments of that design by completing sheets and blanks, the manufacturer may submit to the Bureau of Ships four copies of the basic manual together with examples of the sheets and blanks which will represent the detailed information to be provided for a specific equipment. Approval of a class A manual will be by the Bureau of Ships only and, once approved, the basic manual shall not be modified without the approval of the Bureau of Ships. At the time of class A manual approval, the Bureau will assign a NAVSHIPS number to the basic manual and forward one copy to the cognizant inspection for future comparison inspection with manuals furnished for specific equipments.

3.1.1.1 Once approval of a class A manual is granted for a particular basic design of equipment (and size range, if appropriate), the basic manual with the specific detailed information required for the unit of the family being furnished on a contract or order may be supplied by the manufacturer, in the quantities required by that order, without further approval. Copies of the manual prepared for the specific equipments shall be marked by the manufacturer with the NAVSHIPS number of the basic manual followed by "-1", "-2" or higher. Each dash number shall be assigned numerically by the manufacturer for each specific equipment of that family.

3.1.2 Class B manuals. - Class B manuals cover a specific equipment for which class A approval has not been obtained. Once a class B manual has been approved by the Bureau or its field representative, the manual shall not be modified without approval of the Bureau of Ships. (NOTE: Bureau of Ships field representative - Where the term "field representative" is used in this specification, it is limited to field representative of the Bureau of Ships, i.e. Supervisors of Shipbuilding, USN, U.S. Naval Shipyards and Industrial Manager, USN.) Whenever a manual for a specific equipment has not been approved previously, for this or a previous issue of this specification, prior to preparing final manuals, the manufacturer shall prepare and submit a sample manual for approval to one of the following activities, as appropriate:

(a) Manuals procured on Bureau of Ships contracts - Contractor shall forward four sample copies to the Bureau of Ships for approval and assignment of a NAVSHIPS number with a copy of the forwarding document to the cognizant Government inspector.
(b) Manuals procured on contracts issued by Naval activities other than Bureau of Ships - Contractor shall forward four sample copies to the Naval activity for approval.
(c) Manuals procured for the Navy by a commercial activity (such as a private shipbuilder) - Contractor shall forward five sample copies to the commercial activity for approval of both the commercial activity and the cognizant Bureau representative.

3.1.2.1 The Bureau will assign a NAVSHIPS number to each different class B manual as follows:

(a) Manuals procured on contracts issued by the Bureau of Ships - The NAVSHIPS number will be included in the approval letter.
(b) Manuals procured on contracts issued by other activities.

The field approving activities may obtain NAVSHIPS numbers from the Bureau of Ships by one of the following methods:

(a) Submit two copies of the manual prior or subsequent [redacted] to the review and approval.
(b) Permit the manufacturer to forward two copies of the manual to the Bureau simultaneously with the copies for approval.
(c) In urgent cases, submit a letter containing the nameplate data of the equipment, the ship applicability and contract or order number.

3.1.2.2 Regardless of the method used for obtaining NAVSHIPS numbers, the letter request shall state the expected delivery date of the manuals and the quantity of manuals being furnished for stock.

3.1.3 Emphasis. - The Bureau of Ships is mainly interested in the adequacy and completeness of contents and the clarity and readability of the information rather than the format. The manual shall be oriented toward operation, maintenance and repair of the equipment by the forces afloat, without the services of a manufacturer's representative. The portions devoted to descriptive matter and theory shall be limited to those which are essential to a proper understanding of the equipment for satisfactory operation, maintenance and repair. The text need not duplicate information which is adequately shown on the photographs, drawings and illustrations incorporated in the manual. (A class A or B manual may be the manufacturer's commercial manual, or one prepared in accordance with his commercial practice whenever it will be suitable for the service intended as determined by the approving activity.)

3.1.4 Security classification. - The security classification of manuals shall be as designated by the bureau or agency concerned. If classifed, the security guide issued by DD form 254, forming a part of the contract shall be followed. All pages shall be marked in accordance with the requirements of the Industrial Security Manual for Safeguarding Classified Information (DD 441 (Attachment)). Where a minor amount of classified information is involved, two volumes - one unclassified and one classified shall be provided. The word "UNCLASSIFIED" need not appear on each page of unclassified portions of classified manuals. Revisions shall be classified as required by their subject matter. Regardless of the overall classification of a classified publication, an unclassified title shall be assigned whenever possible and consistent with security and clarity. In all cases, however, if a classified manual is involved, the initials of the classification assigned to the title, standing alone, shall be indicated in parentheses immediately following the title, using one of the following notation (U), (C), (S), (TS). In addition, the covers of classified manuals shall include the markings as indicated on figure 1.

3.1.5 Detail requirements. -

3.1.5.1 Contents. - Manuals shall contain the following information, arranged in an order appropriate to provide adequate instruction for operation and maintenance of each unit in the equipment and the complete assembly: No particular arrangement, format or chapter titles are required as long as the information is suitably presented.

Front Matter
General Information
Installation
Principles of Operation
Operating Instructions
Maintenance and Repair
Parts Lists

3.1.5.2 Front matter. - The front matter shall consist of the following:

(a) Cover
(b) Title page (for classified manuals only)
(c) Approval and procurement record page
(d) List of effective pages
(e) Table of contents
(f) List of figures
(g) List of tables

3.1.5.2.1 Cover and title page. - The cover shall contain the information on figure 1. The title page for classified manuals shall conform to figure 2.

3.1.5.2.2 Approval and procurement record page. - The approval and procurement record (APR) page shall be the first page of unclassified manuals and shall follow the title page of classified manuals and shall conform to figure 3.

3.1.5.2.3 List of effective pages. - A list of effective pages shall be included. In multiple volume manuals, the list of effective pages shall be included in volume 1 only. The list of effective pages shall be modified whenever revisions are incorporated in copies of the manual.

3.1.5.2.4 Table of contents. - The table of contents shall list all primary divisions and secondary subdivisions such as chapters, sections and pages with their corresponding numbers. Where sub-manufacturers are furnishing associated equipment and a separate manual is not provided, it shall be the responsibility of the prime contractor to integrate and reflect the information provided by the sub-manufacturers within the table of contents. In multiple volume publications, a table of contents shall be prepared for each volume.

3.1.5.2.5 List of figures. - A list of figures shall be prepared listing all figures, their titles and numbers. In multi-volume publications, a list of figures shall be prepared for each volume.

3.1.5.2.6 List of tables. - A list of tables shall be prepared listing all tables, their titles and numbers. In multi-volume publications, a list of tables shall be prepared for each volume.

3.1.6 General information. - General information shall consist of general data, a general description and detailed descriptions, as necessary to supplement data included in drawings and photographs.

3.1.6.1 General data. - General data shall consist of the following data for each component or unit:

(a) Descriptive (name plate) data necessary to identify manufacturer, type, model and performance or design characteristics.
(b) Principal overall dimensions.
(c) Weight.
(d) Allowable capacities, temperatures, pressures, settings, tolerances or other salient features as appropriate to the item shall be shown.

3.1.6.2 General description. - General description shall consist of a short general description of the equipment; explain briefly what it is, what it will do, and the general overall and interrelated operation of the various units. All information of a general character applicable to the complete equipment shall also be given. Where the text contains terms or symbols not commonly used, definitions or explanatory notes shall be included.

3.1.6.3 Detailed description. - Detailed description shall contain a complete detailed description of units and assemblies which comprise the complete equipment; for example: ship service turbo generator: the turbine, reduction gear, generator and exciter.

3.1.7 Installation. - Instructions, if necessary to supplement the installation drawings supplied (in accordance with Specification MIL-D-963), shall consist of methods of installation; including packing or unpacking, handling, preparation of foundation, alignment, precautions, mounting instructions, bolting diagrams, safety guards, grounding or bonding, clearances for access, ventilation, motion under shock, and methods of testing to assure satisfactory installation.

3.1.8 Principles of operation. - Figures, sketches, performance curves, and schematic wiring diagrams shall be included to the extent necessary to provide satisfactory operation, maintenance and repair. Operating sequences of automatic and semi-automatic equipment shall be indicated.

3.1.9 Operating instructions. - Information shall include routine and emergency procedures, and safety precautions; maximum and minimum loads; normal temperatures or pressure limits or both; transfer from manual to automatic operation (or the reverse), to be observed in the starting, operating, stopping, and shutting down of the equipment. In addition, action(s) which should be taken in the event of power failure; control air failure; lube-oil failure; partial failure of equipment; and similar conditions shall be described. Action(s) described in the event of partial failure shall include, where practicable, those procedures necessary to provide continued service of the equipment until time is available to repair the equipment. Where operating procedures are to be performed in specific sequence, step-by-step procedures shall be given. Operations shall be numbered in the order in which they are performed. Tables and charts shall be used for the presentation of these instructions where varying operating conditions are encountered.

3.1.10 Maintenance and repair. -

3.1.10.1 Preventive maintenance. - Instructions shall include all maintenance procedures, inspections, tests, and adjustments which should be performed periodically under shipboard conditions for the purpose of preventing failure or impairment of the equipment. A one page summary and time schedule for maintenance procedures, including a check-off table where appropriate, shall be provided. The summary sheet shall identify any items required by the Navy, as indicated at time of approval action, to be included in the ship's permanent history cards. Where necessary instructions shall include procedures for obtaining access to the sub-components for maintenance. Maintenance instructions shall include, where appropriate, but shall not be limited to the following:

(a) A tabulation of periodic, routine, mechanical, and electrical tests and checks which should be accomplished regularly to show that sub-components are operating properly and to insure continuity of service at optimum performance.
(b) Table or charts, including "wear-limit" charts when appropriate, to indicate what is to be done, when it is to be done based on inspection, and how to do it.
(c) Utilization of the test facilities which may be incorporated in the various components.
(d) Instructions for the care, inspection, and cleaning of all pertinent parts.
(e) Instructions stressing the importance of properly maintaining all safety devices and interlocks provided to prevent damage to equipment or injury to personnel.
(f) Instructions on lubrication at shipboard operating temperatures shall be provided as applicable, preferably in chart form. They shall include information regarding lubrication recommended by the manufacturer and the type of lubricant to be used. Lubricants shall be described by symbol number, Federal stock number, Military specification and industry standard numbers where applicable and known.
(g) Instructions on in-place-balancing or other means of reducing noise level if equipment specifications and shipboard application require quiet operation.

3.1.10.2 Trouble shooting, overhaul and repair. - Instructions shall include all information necessary to permit a technician to locate trouble, and to make repairs, adjustments and conduct tests of each component, assembly or sub-assembly of the equipment. The following shall be included:

(a) Trouble shooting guides for the localization of faults giving possible sources of trouble, the symptons, probable cause, and instructions for remedying the faults.
(b) Complete instructions on signal tracing for electric circuits, use of special test instruments and unusual servicing techniques.
(c) Ample figures and sectional views giving details of mechanical assemblies, and simplified schematic diagrams of electrical, mechanical, hydraulic and pneumatic circuits. Figures contained elsewhere in the manual may be used and referred to under this heading without duplicating them.

3.1.11 Parts list. - The parts list shall include identification data covering all repair parts to facilitate ready identification of parts for replacement and ordering purposes. Standard hardware, structural parts, or other parts which have no maintenance significance shall not be listed.

3.1.12 Special tools. - A separate list of "special tools" which are supplied with the equipment shall immediately follow the parts tabulation; this list shall contain only tools that are peculiar to the equipment showing the quantity, unit of issue (each, pair, set), description, and manufacturer's identification number. A photograph or sketch showing each special tool as it is being used, shall be included in the manual.

3.1.13 Photographs and drawings. - As the preferred alternate to lengthy, detailed discussions, the manual shall make maximum use of shop photographs, with parts annotated for identification. Photographs may be half-tones or glossy prints. Manuals shall contain reproductions of drawings, additional block diagrams and schematic drawings as necessary to supplement the descriptive matter contained in the text. In every case, a drawing or photograph of the assembly shall be included. Diagrams of switches and relays used in the system showing the terminal numbering shall be inserted as additional drawings. Photographs and sketches shall be included wherever necessary for identification of the parts in the "parts list". Other figures shall be included to supplement or extend the information contained in the photographs and drawings as required for further identification of parts and explanation of the descriptive information contained in the text.

3.2 Format. -

3.2.1 Volumes. - Manuals shall be divided into volumes and by chapters or sections as necesary to provide ready handling and to present orderly instructions for operation and maintenance of the equipment, depending on the size and complexity of the manual.

3.2.2 Numbering. - Any section, chapter, page and paragraph numbering system which facilitates adequate indexing and rapid location of pertinent information is acceptable.

3.3 Text. -

3.3.1 Wording. - The text shall be factual, specific, concise, and clearly worded to be readily understandable by personnel involved in the operation, repair, overhaul and maintenance of the equipment, and to provide sufficient information for technicians to install, operate, service; and maintain the equipment at peak performance without the services of a manufacturer's representative. Technical phraseology requiring a specialized knowledge shall be avoided except where no other wording will convey the intended meaning, in which case the technical term shall be defined.

3.3.2 Level of writing. - As a general guide, the level of writing should be that for a high school graduate having specialized training as a technician through Navy training courses.

3.3.3 Figures. - Sectional views of assemblies, sub-assemblies and the component parts thereof shall be shown as necessary to supplement the text, photographs, and drawings and aid in the identification of parts. Identification of illustrated parts with listed parts shall be facilitated by the use of index (or piece) numbers and arrows which will identify assemblies, sub-assemblies and component parts thereof.

3.3.4 Indexing and referencing of figures. - Significant features or components of figures shall be identified by brief applicable nomenclature with arrows. Index (or piece) numbers may be used on figures when an extremely large amount of nomenclature is required.

3.3.5 Deleted figures. - When a change requires deletion of a figure without substitution of another, the following sentence shall be inserted "Figure _____ deleted" in or near the place of deletion.

3.3.6 Notes, cautions and warnings. - Notes, cautions and warnings should be used to emphasize important and critical instructions. The use should be as sparing as is consistent with real need. When used, notes, cautions and warnings should immediately precede the applicable instructions and shall be selected in accordance with the following definitions:

(a) "NOTE" - An operating procedure, condition, etc., which it is essential to highlight.
(b) "CAUTION" - Operating procedures, practices, etc., when if not strictly observed, will result in damage or destruction of equipment.
(c) "WARNING" - Operating procedures, practices, etc., which will result in personal injury or loss of life if not correctly followed.

3.4 Applicability of manuals. -

3.4.1 Identical. - When a class A manual covering a specific equipment or a class B manual which is already available, is applicable in its entirety to the equipment being procured, the applicability is to be extended to include the additional ships by the manufacturer issuing an approval and procurement record page. Copies of the manual required for the ship(s) and local use may be requisitioned from stock by the cognizant Naval supervising activity.

3.4.2 Identical except for minor modifications. - When a class A manual covering a specific equipment or a class B manual is applicable to the equipment being procured except for minor differences, the manufacturer shall modify the manual to cover the differences by the issue of revised or supplementary pages. All revisions to an existing manual shall be approved by the Bureau of Ships, shall require the assignment of a change number, assigned by the Bureau of Ships, and shall be issued by the manufacturer with an approval and procurement record page.

3.5 Revisions. - Revisions to manuals which have been previously distributed shall be prepared as follows:

(a) New pages - New pages shall be issued when it is found necessary to include new information to augment the content of the original manual.
(b) Revised pages - Revised pages shall be issued to make changes which apply uniformly to all equipments covered by the manual.
(c) Supplementary pages - Supplementary pages shall be issued when necessary to provide alternate instructions applicable only to a portion of the total equipments covered by the manual because of minor modifications or minor differences in related components.

3.5.1 Legend for revisions. - All new, revised or supplementary pages shall include the words "new", "revised" or "supplementary", the date and a change number.

3.5.2 Submission for approval. - Four copies of each revision shall be submitted to the Bureau for approval and assignment of a change number. The forwarding letter shall include the number of stock copies and the estimated delivery date of the final copies.

3.6 Production requirements. - Detail materials, printing procedures and assembly for each manual shall be as approved at time of class A or B manual approval. An acceptable arrangement is set forth in the appendix of this specification. Alternate arrangements will be approved if equivalent performance is provided.

3.7 Distribution requirements. - Unless otherwise specified in the contract or order, distribution of all manuals not exactly identical to one previously procured and assigned a NAVSHIPS number shall be as follows:

(a) Two copies for each equipment shall be packed with the equipment when the equipment is shipped to stock.
(b) Two copies for each equipment shall be shipped separately to the cognizant Naval supervising activity marked for each ship on which the equipment is to be installed.
(c) Two copies to the Bureau of Ships.
(d) Three copies to the cognizant Supervisor of Shipbuilding when the equipment is to be installed by a private shipyard. (These copies are in addition to the copies for placement on board the ship.)
(e) Two copies to the Naval shipyard when the equipment is to be installed by that activity. (These copies are in addition to the copies for placement on board the ship.)
(f) One copy to each U.S. Naval Shipyard except Pearl Harbor and Portsmouth Naval Shipyard (total of nine).
(g) Two copies to Pearl Harbor Naval Shipyard (for submarine and surface ship equipment).
(h) Two copies to Portsmouth Naval Shipyard (for submarine equipment only).
(i) One copy to all active submarine tenders (submarine equipment only).
(j) One copy to Submarine Bases, New London and Pearl Harbor (submarine equipment only).
(k) Two copies to Commanding Officer, Ships Parts Control Center, Mechanicsburg, Penn.
(l) One copy to Naval Supply Centers, Norfolk and Oakland.
(m) One copy to Naval Supply Depot, Clearfield, Odgen, Utah.
(n) One copy to Forms and Publications Supply Office, Byron, Georgia.

(o) Manuals for stock shall be in the following quantities:

Number of equipments	Number of copies
1 to 25	25
26 to 99	50
100 and over	100

These manuals shall be shipped to:
Receiving Officer, Naval Supply Depot, Mechanicsburg, Penn.
Marked for COG I stock.

(p) Copies of approval and procurement record pages in accordance with paragraph 3.10.

3.8 Unless otherwise specified in the contract or order, (where manuals are not to be drawn from stock, see 3.4.1) distribution of all manuals exactly identical to ones previously approved shall be as follows:

(a) Two copies for each equipment shall be packed with the equipment when the equipment is shipped to stock.
(b) Two copies for each equipment shall be shipped separately to the cognizant Naval supervising activity marked for each ship on which the equipment is to be installed.
(c) Copies of approval and procurement record pages in accordance with 3.10.

3.9 Revisions. - Revision pages shall be distributed to all activities receiving the original manual, and in the same quantity.

3.10 Approval and procurement record page. - This page shall be included in all copies of the manuals and additional copies distributed as follows:

(a) Two copies to Bureau of Ships.
(b) One copy to Forms and Publications Supply Office, Byron, Georgia.
(c) One copy to Ships Parts Control Center, Mechanicsburg, Penn.

3.11 Military Assistance Program Ships. - Unless otherwise specified in the contract or order, distribution of all final manuals for ships being constructed, reactivated, converted or otherwise readied for transfer under the Military Assistance Program (MAP), shall be as follows:

(a) Two copies for each equipment shall be shipped separately to the cognizant Naval supervising activity marked for each ship on which the equipment is to be installed.
(b) Six copies per equipment for each ship to be transferred under MAP to a foreign government. These copies shall be sent to the Military Assistance Advisory Group (MAAG) of the recipient country for delivery to the foreign government which is to receive the ships.
(c) One copy to the Washington, D. C. Naval Attache of the foreign government to receive the ships.
(d) Two copies to the Bureau of Ships.
(e) One copy to the cognizant Supervisor of Shipbuilding when the equipment is to be installed at a private yard.
(f) One copy to the Commanding Officer, U.S. Navy Forms and Publications Supply Office, Byron, Georgia.
(g) Twelve copies to Receiving Officer, U.S. Naval Supply Depot, Mechanicsburg, Penn., marked for COG-I stock.

4. QUALITY ASSURANCE PROVISIONS

4.1 Contractor responsibility. - The supplier is responsible for the performance of all inspection requirements as specified herein. Except as otherwise specified, the supplier may utilize his own or any other inspection facilities and services acceptable to the Government. Inspection records of the examinations shall be kept complete and available to the Government as specified in the contract or order. The Government reserves the right to perform any of the inspections set forth in the specification where such inspections are deemed necessary to assure supplies and services conform to prescribed requirements.

4.2 Inspection. - Sample copies shall be inspected to determine compliance with the requirements of this specification and for equivalence with the approved (when applicable) sample or basic manual. (If any subsequent issue of manuals is not equivalent to or better than an approved class A manual, class A approval may be withdrawn.)

4.3 Content. - The content of the manual shall be checked against the equipment being furnished to assure that it depicts accurately and adequately the equipment and the operating and maintenance procedures required. The NAVSHIPS number on the manual shall be checked for agreement with the NAVSHIPS number on the equipment identification plate where specified.

5. PREPARATION FOR DELIVERY

5.1 Packaging and packing. -

5.1.1 Individual and multi-volume manuals. - Individual copies and multi-volume manuals shall be packed to preclude damage to material. Multi-volume manuals shall be furnished as complete sets.

5.1.2 Manuals shipped with equipment. - When two copies of the manual are packed with the equipment they shall be packed within the shipping container holding the main unit of equipment. The manual(s) shall be so placed that they are readily accessible prior to removing the equipment and shall not be placed within the vaporproof barrier material used to enclose the equipment. Manuals accompanying equipment shall be packaged in a waterproof container. The invoice packing list or bill of lading shall include the NAVSHIPS number of the manual, the quantity and shall indicate which container includes the manuals.

5.1.3 Bulk shipment. - Manuals shipped in bulk shall not be individually wrapped. Containers shall comply with the Uniform Freight Classification Rules or other carrier regulations as applicable to the mode of transportation.

5.2 Marking. - On bulk shipments, interior packages and exterior shipping containers shall be marked with the following information for each item enclosed, except for shipment of an individual copy or an individual set of manuals:

Box (number) of (number)	(to be listed on multiple container shipments)
NAVSHIPS number	(manual number)
Quantity	(in package)

The words "FOR STOCK" shall be endorsed on the package or packages destined for stock, unless otherwise specified. NAVSHIPS numbers shall be indicated on the shipping documents. When a contract or order requires manuals having different NAVSHIPS manual numbers, the stock copies of each manual number shall be shipped separately.

6. NOTES

6.1 Ordering data. - Equipment specifications and procurement documents shall specify the following:

(a) Title, number and date of this specification.
(b) Quantity of manuals or APR pages required, delivery date and delivery destinations (see 3.7 through 3.11 inclusive).

6.2 Classes of manuals. - The class of manual need not be specified in equipment specifications or procurement documents. The intent is that the manufacturer shall supply class A manuals for any equipment for which he has received class A manual approval. He shall supply class B manuals wherever he has not been granted class A approval.

6.3 Use of term "Service Manual". - Manuals to this issue of the specification are identified as "Service Manuals", instead of "Technical Manuals" since past use of the work "Technical" tended to denote a comprehensive, expensive, theoretical and engineering document whereas all that is necessary is a document that provides for satisfactory operation, maintenance and repair.

6.4 Elimination of types. - Previous issues of this specification have established different types for manuals. Types have been eliminated from this issue. The content and make-up of each manual should be tailor-made to delineate the particular operation and maintenance procedures required.

6.5 Rights in data. - Wherever unlimited rights in data are not obtained, the manual should eliminate all proprietary information if operation and maintenance suitability is not thereby reduced. If proprietary information is required to be included and only limited rights in data are obtained, a restrictive clause per ASPR Section 9 should be included on the cover of each manual for ready identification.

Notice. - When Government drawings, specifications or other data are used for any purpose other than in connection with a definitely related Government procurement operation, the United States Government thereby incurs no responsibility nor any obligation whatsoever, and the fact that the Government may have formulated, furnished, or in any way supplied the said drawings, specifications, or other data is not to be regarded by implication or otherwise as in any manner licensing the holder or any other person or corporation, or conveying any rights or permission to manufacture, use, or sell any patented invention that may in any way be related thereto.

Preparing activity:
Navy - Ships
(Project 7610-N014Sh)

APPENDIX

10. SCOPE

10.1 This appendix covers the requirements for the production of service manuals.

20. REQUIREMENTS

20.1 Quality. - All manuals furnished will be subject to 35-mm microfilming. Letters, lines and symbols shall be of a uniform contrast throughout the documents. Blurred or smudged printing or drop out of characters or lines shall be cause for rejection of the publication. Characters shall be no smaller than 8 point type.

20.2 Typography. - Preferred typography is set forth in table I. When revisions are made to the basic manual, the typography shall conform as nearly as possible to the original manual.

Table I - Typography for 8-1/2 by 11-inch manual.

Use	Type style and size	Capitalization	Leading	Spacing between units
Security classification A condensed	Gothic 14 pt*1	Capitals	6 pt.	
Chapter or section titles	Same type as text	Capitals	6 pt.	48 pt. Following marginal copy, text of illustration 18 pt. Preceding text or illustration
Primary side heads	Same type as text	Capitals	2 pt.	6 pt. Preceding or following text
Subordinate side heads	Same type as text	Capitals	1 pt.	6 pt. Preceding or following text
Figure and table titles	Same type as text	Capitals and lower case	2 pt.	6 pt. Following illustration.

*1 If 14 pt. is not available, next smaller size shall be permitted.

Table I - Typography for 8-1/2 by 11 inch manual, (cont'd)

Use	Type style and size	Capitalization	Leading	Spacing between units
Notes and cautions	Same type as text	Capitals centered	------	4 pt. Preceding and following text
Warnings	Same type as text	Capitals centered	------	4 pt. Preceding and following text
Text, table of contents, list of illustrations etc.	Book face (roman) bold 10 pt.	Capitals and lower case	1 pt.	12 pt. Preceding illustration or following figure title 6 pt Preceding or following notes, cautions, warnings
Keys or legends	Book face (roman) italics 8 pt.	Capitals and lower case	1 pt.	6 pt. Preceding figure title or following illustration 12 pt. Preceding text
Parts breakdown listings	Book face (roman) 8 pt.	Capitals and lower case	1 pt.	6 pt. Preceding bottom rule or following headings
Footnotes	Book face (roman) bold 8 pt.	Capitals and lower case	1 pt.	

NOTES

1. It is not the intent of this appendix to qualify the methods or composing equipment to be used, but to specify results required.
2. Leading and spacing may be relaxed where circumstances require such alterations.
3. The above requirements are for type that will reproduce same size. When oversize pages are used, type shall reduce to approximately these sizes.
4. All type specified may be plus or minus 1 point, except that 8 point type shall be the minimum allowable size.

NOTES TO TABLE I (cont'd)

5. The type faces listed below are the most preferred. They are available in linotype or can be closely matched on office composing machines.

Book face (Roman)
Garamond
Modern
Bookman
Tribune News
Times Roman
Antique
Baskerville
Century

6. Type sizes as indicated in the requirements were selected for conservation of space and legibility and should not be changed except:

(a) When oversize pages are prepared.
(b) When unusual copy fitting problems arise.

20.3 Layout. -

20.3.1 Text pages. - The preferred layout of 8-1/2 inches by 11 inches text pages is two columns 20 picas wide and 54 picas deep, making an overall page image size of 42 by 60 picas. The text and illustration areas shall conserve space without lessening clarity or legibility. Blanks and spaces shall be avoided, ~~except~~ on fold-ins, and the first major division of the manual (chapter or section) shall be a new odd page.

20.3.2 Fold-ins. - Fold-in pages shall be used only for diagrams, drawings or charts which cannot be reduced for satisfactory presentation on a single page, or when frequent reference is required from other pages of the book. Aprons are required. When fold-in pages are used, they should be held to a two-page fold-in whenever practicable and shall not exceed an overall length of 34 inches from the binding edge including the apron. The apron may contain information pertaining to the diagram, drawing or chart.

20.4 Form-punching and drilling. - Service manuals shall be prepared in looseleaf form unless otherwise specified or approved. Looseleaf publications and revisions shall be punched for looseleaf binding with three holes one-fourth inch in diameter and four and one-fourth inches center to center (for 8-1/2 by 11 inch pages) or with such other drilling or punching as specified. Punching of revision pages shall be the same as punching of the original manuals.

20.5 Size. - Suggested sizes for final trim of service manuals follow:

4-3/8 by 6-3/4
8-1/2 by 11

All dimensions are in inches.

20.6 Paper stock. -

20.6.1 Text pages. - Paper stock for text pages shall be as specified in 20.6.1.1 or 20.6.1.2.

20.6.1.1 Lithography. - Paper stock shall be white offset book free from unbleached or ground woodpulp and shall have a substance weight of not less than 100 pounds per 1,000 sheets; basis 17 by 22 inches.

20.6.1.2 Letterpress. - Paper stock shall be equivalent to white super-calendered book containing not to exceed 5 percent unbleached chemical wood or ground woodpulp; the remainder to be bleached chemical woodpulp, and shall have a substance weight of not less than 90 pounds per 1,000 sheets, basis 25 by 38 inches.

20.6.2 Fold-ins. - Paper stock for fold-in pages shall be equivalent to high wet strength lithographic map, free from unbleached or ground woodpulp, and shall have a substance weight of not less than 48 pounds per 1,000 sheets, basis 17 by 22 inches.

20.6.3 Binders. - Binders shall be of plastic or pressboard and shall accommodate looseleaf manuals punched or drilled as specified in 20.4 and shall facilitate insertion of replacement pages. Commercial type fasteners are to be used. Information to be included on the binders shall not be stamped with gold or any other metal foil. Binder colors for unclassified manuals shall be any color except yellow or red. Binders for confidential manuals shall be red. Binders for secret and top secret manuals shall be yellow.

MIL-M-15071D(SHIPS)

NAVSHIPS 000-00 VOLUME I OF III
SECURITY CLASSIFICATION

NAV
SEC

NAV
SEC

NAV

TITLE OF MANUAL (U)

GROUP CLASSIFICATION MARKING (for classified manuals. See DD254)

SECURITY CLASSIFICATION

Figure 1 - Cover.

NAVSHIPS 000-000
SECURITY CLASSIFICATION

MIL-M-15071D(SHIPS)
VOLUME I OF III

TITLE OF MANUAL (U)

WARNING: This document contains information affecting the national defense of the United States within the meaning of the Espionage Laws, Title 18, U.S.C., Sections 793 and 794. The transmission or the revelation of its contents in any manner to an unauthorized person is prohibited by law.

SECURITY CLASSIFICATION

Figure 2 - Title page.

Approval Authority shall include the applicable letters or correspondence granting approval in conformance with approval procedures.

Remarks space shall be used for necessary comments and the inclusion of information regarding the extension of a manual by minor revisions.

Certification: One of the following certification paragraphs shall be typed in this space, as appropriate:

For Class A manuals covering specific equipments.

It is hereby certified that NAVSHIPS _____ is identical to the basic manual NAVSHIPS _____ approved by the approval data shown above except for the detailed information required for the equipment provided under contract or purchase order _____.

For original Class B manuals.

It is hereby certified that NAVSHIPS _____ to be provided under contract or purchase order _____ has been approved by the approval data shown above.

For identical Class A manuals covering specific equipment and Class B manuals.

It is hereby certified that the manuals to be provided under contract or purchase order _____ are exactly identical to NAVSHIPS _____ approved by authority of approval data shown above.

For Class A manuals covering specific equipment and Class B manuals which have been previously distributed but required minor modification.

It is hereby certified that the manuals to be provided under contract or purchase order _____ are exactly identical to NAVSHIPS _____ approved by the approval data shown above except for the necessary modification as shown in the above remarks space.

NOTE: This page may be typed and reproduced by any economical method and shall be included in [redacted] Class B manuals and copies of final manuals.

APPROVAL AND PROCUREMENT RECORD PAGE

APPROVAL DATA FOR: NAVSHIPS _____
TITLE OF MANUAL:

APPROVAL AUTHORITY:

CONTRACT OR PURCHASE ORDER	SHIPS APPLICABLE	QUANTITY OF MANUALS	QUANTITY OF EQUIPMENT	BUILDING YARD

REMARKS:

DATE _____

CERTIFICATION:

MANUFACTURER'S SIGNATURE
MANUFACTURER'S NAME AND ADDRESS
FEDERAL CODE NUMBER (HOME OFFICE)

CHANGE NO.

Figure 3 Approval and procurement record page

SPECIFICATION ANALYSIS SHEET

Instructions

This sheet is to be filled out by personnel either Government or contractor, involved in the use of the specification in procurement of products for ultimate use by the Bureau of Ships.

This sheet is provided for obtaining information on the use of this specification which will insure that suitable products can be procured with a minimum amount of delay and at the least cost.

Comments and the return of this form will be appreciated.

Fold on dotted lines on reverse side, staple in corner, and send to Bureau of Ships, Specifications and Standardization Branch, Washington 25, D.C.

Specification

Organization	City	State
Contract No.		
Quantity of Items Procured		Dollar Amount $

Material procured under a direct Government contract ☐ or a subcontract ☐

1. Has any part of the specification created problems or required interpretation in procurement?
   a. Give paragraph number and wording

   b. Recommendations for correcting the deficiencies

2. Comment on any specification requirement considered too rigid

3. Is the specification restrictive? If the answer is "Yes", in what way?
   ☐ Yes ☐ No

4. Remarks (Attach any pertinent data which may be of use in improving this specification. Place this form and papers in an envelope and send to the Bureau

Submitted by (Print name and activity)	Date

Fold

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BUREAU OF SHIPS
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EXHIBIT E

Exhibit E

TO THE AFFIDAVIT OF ADMIRAL HORNE

THE HUMAN MACHINE

Biological Science for the Armed Services

By

CHARLES W. SHILLING

Captain, Medical Corps, United States Navy

A NAVAL INSTITUTE PUBLICATION

Printed in the United States of America

FOREWORD

IT IS A CURIOUS FACT about man, particularly the military man, that his knowledge of the physical world that surrounds him is always so much more highly developed and systematized than his knowledge of self. Why man should be so concerned with his physical environment to the frequent exclusion of a logical interest in himself, I do not know, but I am not given to arguing with observable facts.

It was in a discussion of this idea with Captain Shilling that I suggested we need not look further than the Naval Academy Yard for an illustration of the point. We pride ourselves here at the Naval Academy on keeping abreast of developments in technical fields and on the techniques of teaching and learning. But in a basic subject like Hygiene we were depending on a textbook prepared before World War II. This new book, *The Human Machine*, is the result of that discussion.

Although this text was prepared to meet the specific needs of the Department of Hygiene at the United States Naval Academy, its value and usefulness to people of all the Services generally will be apparent.

C. TURNER JOY
Vice Admiral, U. S. Navy

PREFACE

A LIMITED EDITION of this book was designed originally for the Hygiene Department of the United States Naval Academy as the basis for a course of instruction in biological science. The revised version in hand, however, was prepared to meet the needs of all nonmedical military personnel, and not merely the requirements of one particular group. The style of presentation has been kept informal, with a minimum of medical and technical terminology.

The text itself seeks to offer, in a simple and concise manner, information on the structure, function, and hygiene of the human body, in the belief that an understanding of man's physical being is essential to the process of self-assessment and personal adjustment in relation to the demands of military life. It should be pointed out, nevertheless, that if we are to recognize and interpret the complex patterns of human behavior in the military environment, there is need for a companion study on the human personality, since that material cannot be included in this text.

Considerable space has been allotted to the subject of group hygiene, preventive medicine, and sanitation. In a military organization, familiarity with these problems will help prepare the man in the Service for a higher degree of responsibility in his role as a leader. At all times, and under all conditions, health of the command remains of paramount importance.

In the complex functioning of our military organization, in peace and in war, the role of our medical personnel has increased steadily in scope. To traditional tasks, whole new areas of activity have been added—and ranking high among these, the study of the intricate, mutual relationships of man and machine. But still greater problems have risen to challenge us. Atomic, biological, and chemical warfare may present us with situations of as yet unexperienced environmental stress. If we, as military personnel, are to maintain a strong and resourceful posture in the face of these situations, our preparedness must be based upon firm knowledge and calm evaluation of their true nature.

CHARLES W. SHILLING
Captain, Medical Corps, U. S. Navy

2

4. ENVIRONMENTAL INJURY

The human machine has a remarkable ability to adjust to its environment; however, occasionally it is overwhelmed by some extreme environmental situation, and as a consequence disease, injury, or death may result. Exposure to extremes of temperature causes most of the difficulties encountered by Service personnel.

The direct effect of extreme *cold* is the freezing of a part or of the entire human body. That this can easily happen is attested to by records of death occurring every winter right here in our own country, and it does not get as cold here as it does in some other places. The lowest recorded temperature on earth is −95° F. reported in northern Siberia. There in the summer the heat goes to +90° F. So the human machine must adjust or protect itself against an annual range of almost 200°. The coldest temperature reported in North America was −79° F., observed at Fort Good Hope, 20 miles south of the Arctic Circle.

The indirect results of extreme cold are such conditions as frostbite, chilblain, and trench foot. Trench foot was an important cause of disability in both World Wars. In World War I there were 2,000 cases among American troops, and in World War II, during the invasion of Western Europe, there were 11,000 cases in the month of November of 1944. Immersion foot is a very common condition developing in almost everyone who spends time on a life raft with his feet in water.

Snow blindness and sunburn can both result from reflected light from the snow or ice.

It is apparent that to endure the extremes of cold, the human machine must be protected by heated buildings if it is to survive for any great length of time. It is possible to design clothing and protective masks, mittens, and shoes so that an individual can for hours withstand extremes of temperature that would otherwise freeze him within a few minutes. In general, clothing should be worn in several layers, rather than a single one, because air pockets are trapped between these layers. The outer garment should be windproof to prevent excessive heat loss from air movement. It should be water repellent, because wet clothing is a poor insulator. Loose-fitting garments are better than tight-fitting garments, because they entrap air and do not interfere with blood circulation. Leather mittens lined with knitted wool are effective protectors of the hand.

During the Korean campaign the Navy developed an excellent cold weather boot which effectively prevented freezing of the feet. It is interesting to note that this boot, because it had an entrapped air-layer cushion, was also effective against injury of the feet from exploding land mines.

The direct and indirect effects of *heat* are localized injuries familiar to us as burns or scalds, or the general systemic effects of heat cramps, heat exhaustion, or sunstroke. All of these conditions are of importance to the Navy, because, despite everything that can be done, in the engine-rooms of our ships temperatures frequently rise to a level which may cause heat cramps or heat exhaustion. Numerous cases of sunstroke have occurred among our Marines who in their marches were exposed to the extreme heat of the sun. One of the secondary effects of heat that disturbs Service personnel greatly is what we call "prickly heat" or "heat rash." This was particularly serious in submarines prior to the installation of air conditioning, and, because of the constant nerve-racking irritation, resulted in lack of efficiency.

The environmental injuries due to changes in *air pressure* are discussed in the chapters on Aviation Medicine and Underwater Activity. However, these two chapters do not mention one environmental condition which troubles a person who first climbs a high mountain. At the higher altitudes there is a lower atmospheric pressure, with resulting oxygen deficit, which leads to anoxemia, known as "mountain sickness." Fortunately, the individual is able to become acclimated within a matter of a day or two, and there are no permanent effects.

Although *poisonous gases* are discussed in detail in the chapter dealing with Chemical Warfare, yet it is well to point out here that there are many industrial gases that also may cause disease and death. Carbon monoxide, methane, hydrogen sulfide, and chlorine are examples of industrial gases.

There are many *poisonous liquids* and *solids* which disrupt the internal mechanisms of the human machine. Among the most common of these are wood alcohol, sleeping tablets such as barbiturates, various acids and alkalies, and, of course, arsenic—famous as a means of poisoning.

There are also *dusts* and *vapors* which cause injury and occasionally death. For example, dust

causes such diseases as silicosis, anthracosis, and other diseases due to the inhalation of such materials as asbestos dust, iron dust, tobacco dust, etc.

Beryllium poisoning has been a more or less recent industrial hazard and one that so far has baffled the medical profession. Beryllium at one time was used to coat the interior of all fluorescent lights. It is used by atomic energy workers at the present time, but it must be handled with great care, or injury and death will result.

No discussion of dust as a cause of injury would be complete without the mention of *smog*. Smog was forcibly brought to our attention by the catastrophe in the little Pennsylvania town of Donora and by the occurrence of a similar catastrophe on a much greater scale in London. The table below, recording registered deaths per million inhabitants in the administrative County of London, shows the severity of the 1952 situation compared to the cholera epidemic of 1866 and to the worst week of the 1918 flu epidemic.

Week of:	Deaths	Normal for period and season	Excess over normal
Aug. 4, 1866 (cholera).....	876	450	426
Dec. 20, 1873 (*fog*).....	713	470	243
Nov. 9, 1918 (influenza)....	1,085	300	785
Dec. 13, 1952 (*fog*).....	745	300	445

You can see why it has been said that the atmosphere is the world's greatest sewer. In spite of this, no difficulty apparently results except under certain meteorologic conditions when there is an atmosphere inversion, with no movement of the air away from the earth's surface, for long periods of time. Under these conditions, organic waste, coupled with high humidity and fog, leads to serious contamination of the air. Normal air pollution is a problem on which industry alone is spending an estimated $120,000,000 a year for its control, and many cities have extensive campaigns to combat the problem. There are a number of people who feel that there is a direct relationship between the sharp rise in primary lung cancer and the rise in air pollution in all of our larger cities.

Lightning and man-made *electricity* are also the cause of disaster so far as the human machine is concerned. Closely allied to these are x-rays, radium, and the various by-products of splitting the atom, such as gamma rays, and alpha and beta particles, and various radioactive isotopes. Much of this material will be covered in the section on Atomic Warfare.

This discussion of environmental injuries would not be complete without calling attention to the more violent attacks by nature in such manifestations as earthquakes, hurricanes, floods, and snowslides, which annually take a heavy toll on a worldwide basis.

5. NUTRITIONAL DISORDERS

The problem of nutrition has already been discussed in some detail in the section dealing with the human machine's equipment for energy production. However, it is here worthwhile to point out that at least two-thirds of the inhabitants of the world never have enough to eat and are therefore malnourished, with many facing starvation. The situation is getting worse all the time. Of the "Four Horsemen" of the Apocalypse, Famine should be the captain, for he weakens the body so that War, Greed, and Pestilence find a fertile field. It is hard for anyone in this country to realize it, but Herbert Hoover, following a recent survey, pointed out such marked food shortages in various parts of the globe that 800,000,000 persons are now faced with "the grimmest spectre of famine in all the history of the world."

Despite the fact that we live in a land of plenty, our food fads lead to a situation in which many people in this country become victims of malnutrition. Some of the diseases and nutritional disorders are such conditions as pernicious anemia, iron deficiency anemia, simple goiter, rickets, beriberi, pellagra, scurvy, and various other diseases resulting from lack of vitamins or proper nutrition.

Of all these, the one most important to the Navy is scurvy. In the early days of sailing ships, and prior to the discovery that ascorbic acid found in limes, lemons, and other citrus fruits prevented this ailment, the crew on a long voyage was sometimes so stricken that only a fraction of those who set out ever returned.

In this discussion of nutritional disorders we should not forget the fact that in this country there is more danger of becoming too fat due to overeating than there is in any other dietary or nutritional difficulty. Always remember, the best

Chapter XX

MILITARY MEDICAL ORGANIZATION

FROM EVEN a cursory review of this text it will be evident that the medical component of the military organization has a heavy responsibility, and that if it is properly organized and functioning, it is in a position to contribute greatly to the success of any and all military operations. This chapter is designed to furnish a brief review of pertinent facts concerning medical organization.

In the Department of Defense, there is an Assistant Secretary of Defense for health and medical affairs. There is a Medical Department in each of the three Services, headed by a Surgeon General who is a Medical Officer, usually of the rank of Major General in the Army and in the Air Force, and a Rear Admiral in the Navy. These medical departments contain personnel trained in medical, dental, and collateral sciences and have the facilities and administrative structure necessary to provide efficient medical and dental services at all levels in the military structure of the three Services.

The mission of the Medical Department of the Navy can be stated very briefly as: promotion of physical fitness; prevention and control of diseases and injuries; and treatment and care of the sick and injured. Obviously, in order to fulfill this responsibility the Medical Department is actively concerned with all phases of life in the Navy and advises all components of the Navy on matters which may affect the health and well-being of naval personnel.

The central administrative organization for the Navy* Medical Department is the *Bureau of Medicine and Surgery,* which is headed by the Chief of the Bureau of Medicine and Surgery, a Rear Admiral, who is also the Navy Surgeon General; and a Deputy Chief of the Bureau, also of the rank of Rear Admiral. There are five assistant chiefs of the Bureau: one for personnel and professional operations; one for planning and logistics; one for aviation and operational medicine; one for research and military medical specialties; and one for dentistry. In addition, there are four divisions directly under the Deputy and Assistant Chief of the Bureau: the administrative division; the comptroller division; the medical statistics division; and the publication division. There is an Inspector of Naval Medical Activities and an Inspector of Naval Dental Activities. This is the administrative center for all of the medical activities of the Navy, but considerable authority is delegated to the field medical and dental representatives who serve on the staffs of the Fleet, Force, Naval Frontier, District, and River Commands.

Detailed information concerning operational components of the Medical Department is obviously not indicated in this discussion. However, every naval officer should at least be cognizant of the facilities of the Medical Department. These include numerous hospital and dental clinics located throughout the United States and at various overseas bases, operated under the command of a medical or dental officer; many dispensaries located in naval activities all over the United States which are operated under a Medical Officer-in-Charge; and hospital ships which are models of efficiency. In addition, there are sick bays manned by medical personnel in all of the units of our Fleet. All of the hospitals, dispensaries, and larger ships have dental officers as well as medical officers, and the dental service rendered even at sea is of the highest type obtainable anywhere.

There is a Medical School, a Dental School, and a Medical Research Institute located at the National Naval Medical Center, Bethesda, Maryland. There are also numerous other research units established in connection with operational activities throughout

* Note: No attempt will be made to discuss the medical departmental organization for either the Army or the Air Force; however, it may be stated that it closely parallels their military organization and is quite similar to that in the Navy. For further information concerning the organization and function of the Medical Department of the Navy, see the *Manual of the Medical Department,* a copy of which is available in all medical activities.

the world. The functions and duties of the personnel of all of these activities are prescribed in great detail, but suffice it to say here that the Medical Department and all of its component parts are actively working with the operational forces of the Navy, in all areas of naval importance.

Medical Department personnel. All of the activities mentioned above are manned by Medical Department personnel who are organized into five separate corps composed of specialized personnel—Medical Corps, Dental Corps, Medical Service Corps, Nurse Corps, and Hospital Corps. In order that you may have some idea of the qualifications and background of the people you will be associated with in your naval career, we shall discuss very briefly certain facts concerning the personnel of these five corps.

The Medical Corps is composed of doctors of medicine who have graduated from an accredited medical school and have successfully completed an acceptable internship. These doctors come into the Navy in the rank of Lieutenant (junior grade). They are allowed three years constructive service credit for the four years of medical school and the one year internship which they have completed following the required four years of college.

Although it may be that some of the more junior doctors are not completely familiar with Navy tradition and custom, it can be safely assumed that with the training and experience as noted above they are well qualified to make medical decisions. The Navy has maintained a policy of sending its Medical Department personnel out for additional education, so that most of the doctors who head departments in our naval hospitals have had specialized training and are accredited by the American Medical Association in the specialties in which they are working. These specialists are just as capable in their field as are their brother specialists in civilian life.

The Dental Corps is composed of doctors of dental surgery who have graduated from accredited dental schools, many of whom have completed a year of dental internship. They, like the medical officers, enter the Navy as Lieutenants (junior grade) and are allowed three years constructive service. They also are given additional education and training, and a number are accredited by the American Dental Association in specialties of dentistry. Like the physicians of the Navy, they rank, professionally, with their brother practitioners in civil life.

The Medical Service Corps is composed of personnel trained in administration and supply, pharmacy, optometry, sciences allied to medicine, and any other such field as may be deemed necessary by the Secretary of the Navy. At the present time there are four main divisions of the Medical Service Corps: the Administrative and Supply, Pharmacy, Optometry, and the Medical Allied Sciences. As would be expected, these four divisions are staffed by: hospital corps personnel appointed as Ensigns in administration and supply; graduates of schools of pharmacy; individuals holding a baccalaureate degree in optometry; and scientists or research personnel who hold graduate degrees in such subjects as chemistry, physics, biology, physiology and so forth.

The Nurse Corps. The nurses of the Navy hold rank from Ensign through the rank of Captain and are all graduates of accredited schools of nursing, many of which now require a college degree in addition to the nursing training. Nurses serve most efficiently in all of our hospitals, in most of the dispensaries, and in our hospital ships and military sea transport ships, but not in other ships of the Navy.

The Hospital Corps of the Navy has a long and very enviable record of outstanding service. In 1814 there was a "loblolly boy" who assisted the surgeon. Later he became the surgeon's steward. The Hospital Corps as such was officially organized in 1898. One cannot praise too highly the work of this group. As a matter of fact, the commendation written by the Honorable James Forrestal when he was Secretary of the Navy should be read by "all hands" in its entirety. I quote here a few sentences: "You Corpsmen performed fox-hole surgery while shell fragments clipped your clothing, shattered the plasma bottles from which you poured new life into the wounded, and snipers' bullets were aimed at the brassards on your arms. On Iwo Jima, for example, the percentage of casualties among your Corps was greater than the proportion of losses among the Marines. Whatever their duty, wherever they were, the men and women of the Hospital Corps served the Navy and served humanity, with exemplary courage, sagacity and effort. Out of every 100 men of the United States Navy and Marine Corps who were wounded in World War II, 97 recovered. That is a record not equaled anywhere, anytime. Every individual who was thus saved from death, owes an everlasting debt to the Navy's Hospital Corps. No wonder men and women are proud

to wear the emblem of the Hospital Corps!"

In the interest of knowing the various specialties of the men with whom you will be working, the following is quoted from the *Manual of the Medical Department*,[5] Chapter 9, paragraph 3, Enlisted Rating and Warrant Structure:

"The Hospital Corps is composed of enlisted rates and ratings and warrant officers and commissioned warrant officers, divided into four groups which are classified by the Bureau of Naval Personnel as Hospital Corps, Group X, Medical; Hospital Corps, Group XI, Dental; Warrant Officers, Hospital Corps, and Commissioned Warrant Officers, Hospital Corps, 817; and Warrant Officers, Hospital Corps and Commissioned Warrant Officers, Hospital Corps, 818. The following are the Group X rates: hospital recruit, hospital apprentice; hospitalman; hospital corpsman, third class; hospital corpsman, second class; hospital corpsman, first class; and chief hospital corpsman. These rates lead to Warrant Officer, Hospital Corps, 817. The following are the Group XI rates: dental recruit, dental apprentice; dentalman; dental technician, third class; dental technician, second class; dental technician, first class; and chief dental technician. These rates lead to Warrant Officer, Hospital Corps, 818."

Research. As it is with other components of the Navy, research is an intimate part of the Medical Department activity, the importance of which cannot be overemphasized. Through research we assist in the development of new equipment, new and better methods of care and treatment of various diseases and injuries; help in the problem of adjustment of naval personnel to all of the new and strange environmental situations in which they are placed; and, in general, provide the knowledge necessary for the more efficient operation of the Navy.

Research under the cognizance of the Bureau of Medicine and Surgery is accomplished in a large medical research institute, in several research laboratories, fleet and shore-based units, and in various naval hospitals. The scope of this research is extremely broad and parallels the total activity of the Navy.

The Line-Staff Corps Officer relationship. In your future position as Division Officers, and particularly as Executive and Commanding Officers of Ships and Stations, it is imperative that you have a clear understanding of your relationship to your Staff Officers. It is also extremely important for a happy, well-operated, and efficiently functioning command that your relationship with your Staff Officers be a smooth and, if possible, amicable one.

It is well understood by all officers, both Line and Staff alike, that the function of Line command is solely the prerogative of the Line Officer. The duties of the Line Officer and of the Staff Corps Officer are all very carefully detailed by the Navy Department and by the various Bureaus so that no difficulty should arise due to any misunderstanding resulting from failure to *know* what should be done.

Most of the misunderstandings which all of us have seen from time to time in the Service are the result of clashing personalities or of the assumption of command prerogatives which are unwarranted. It is understood and fully appreciated that the Commanding Officer can issue orders to any officers within his command. However, he would be well advised to refrain from issuing orders in technical fields without the advice and concurrence of his specialists. The reason for having physicians, dentists, supply officers, paymasters, chaplains, and others, is for the specialist service which they can render to the Navy, and incidentally to the Commanding Officer in the operation of his ship; and there must be a compelling reason in order to justify overruling their judgment in a professional matter.

On the other hand, for the Staff Corps Officer to make any attempt to assume Line command functions, or even to presume to give advice in this area, is completely "out of line."

As prospective Commanding Officers, it is wise for you to remember that the prerogative of command does not necessarily mean that you have to have the answers to everything in your own head. No one in our present-day, complex Navy expects it. The Commanding Officer is not only a more efficient, but a bigger and better naval officer if he listens to professional advice in the areas in which he obviously cannot be competent.